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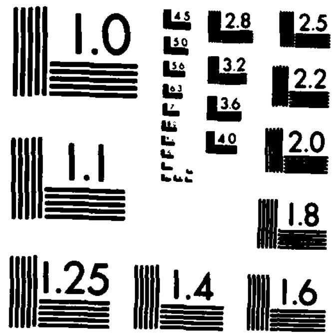

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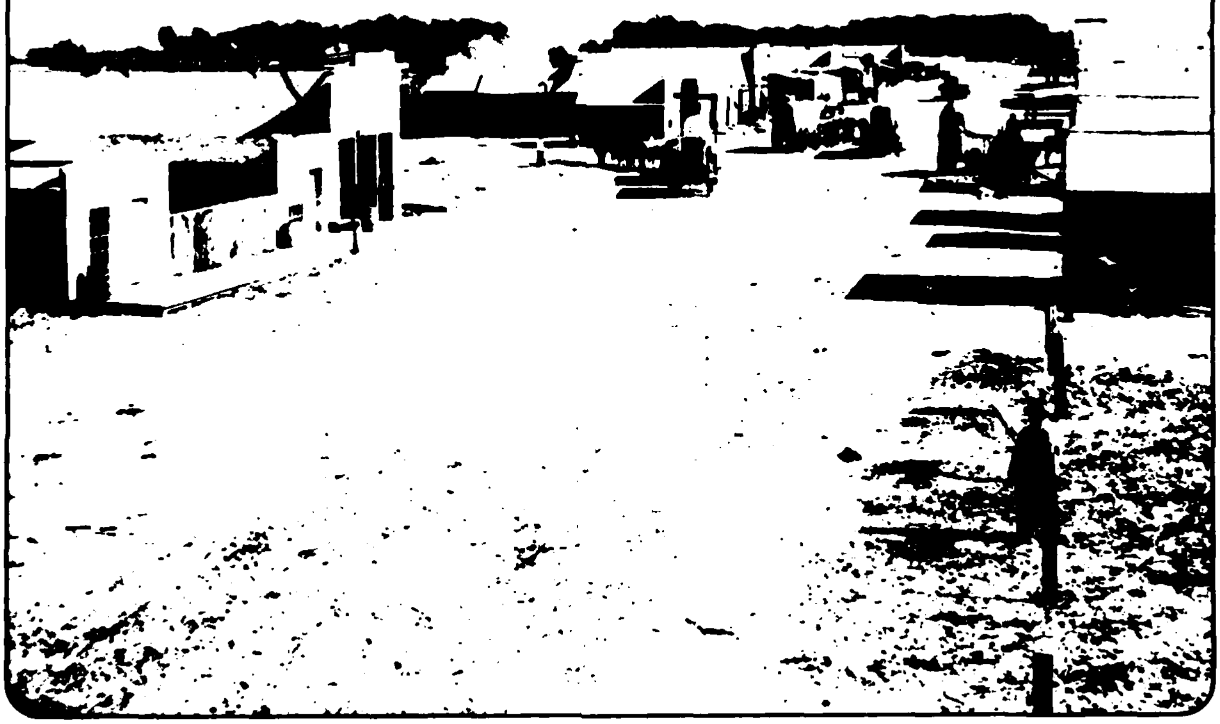

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Science Applications, Inc. (SAI) conducted a cultural resources inventory of the John Martin Dam and Reservoir, Bent County, Colorado under a contract with the U.S. Army Corps of Engineers, Albuquerque District. The fieldowrk consisted of a perdestrian-type, close interval survey which located and recorded 133 archeological sites. These sites included 111 prehistoric components and 34 historic components. In addition, 103 isolated finds were recorded. The analysis of the data collected during the fieldwork

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addressed both research and management problems. During the analysis phase of the project, the cultural resources were separated according to the two major periods of human occupation: prehistoric and historic. In both cases, the archeological and archival data were quantified where possible to address specific research questions and hypotheses. The prehistoric sites were investigated in terms of settlement variability from both funciotnal and evolutionary perspectives. The historic sites were examined in light of demographic, settlement, and land-use questions. Judging by the presence of time-diagnostics the prehistoric occupation of the project area extended from the Archaic Period through the Plains Apache of the eighteenth century. The research orientation was to conduct piece-plotting of artifacts at each archeological site for purposes of studying intrasite and intersite variability. The data were organized as 59 quantified observations suitable for computer and statistical manipulation. Using a computer, research hypotheses dealing with functional, chronological, and evolutionary questions were tested. From these analyses two site types were defined: base camps and special activity areas. Most of the historic sites were farmsteads of ranch-related features which dated from the late nineteenth and early twentieth centuries. Quantitative techniques were utilized to examine data collected from both archeological observations and archival research. It was found that the project area was permanently settled by Euro-Americans mainly after 1880. The majority of these people were native-born Americans who came to the area to establish small livestock ranches and farms.

ERRATA SHEET

Cultural Resources Inventory of the John Martin Reservoir, Colorado

1. Page 80: Distance Formula should read:

$$dp = \sqrt{(X_p - X_{p-1})^2 + (Y_p - Y_{p-1})^2}$$

2. Page 84: Zc equation should read:

$$Z\,c = \sum_{i=1}^{10} (\bar{ro}_i / ro_i)$$

3. Page 199: One sample chi-square:

$$X^2 = \sum_{i=1}^{K} \frac{(O_i - E_i)^2}{E_i} \quad \text{Where: } E_i = N/K$$

Binomial (corrected for continuity)

$$Z = \frac{(X \pm 0.5) - NP}{\sqrt{NPQ}}$$

4. Page 204, Table 6.7, last page: Site density, exponents are missing.

5. Page 205, Table 6.8: The symbol used for sigma is wrong. The symbol is used elsewhere as alpha.

6. Page 207, 3rd para, 3rd sentence: N_1 should be n_i, and the statement 0.0336 (>0.05) should read 0.0336 (<0.05).

THE CULTURAL RESOURCE INVENTORY
OF THE
JOHN MARTIN DAM AND RESERVOIR,
BENT COUNTY, COLORADO

PREPARED FOR: Corps of Engineers,
Albuquerque District
New Mexico

SUBMITTED BY: Science Applications, Inc.
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GEOLOGICAL CONTRIBUTIONS: Vance T. Holliday
Judith Van Couvering

CONTRACT NUMBER: DACW47-80-C-0002

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August 31, 1982

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SECTION 1.0
ABSTRACT

by Paul D. Friedman and Frank W. Eddy

Science Applications, Inc. (SAI) conducted a cultural resources inventory of the John Martin Dam and Reservoir, Bent County, Colorado under a contract with the U.S. Army Corps of Engineers, Albuquerque District. The fieldwork consisted of a pedestrian-type, close interval survey which located and recorded 133 archeological sites. These sites included 111 prehistoric components and 34 historic components. In addition, 103 isolated finds were recorded.

The analysis of the data collected during the fieldwork addressed both research and management problems. During the analysis phase of the project, the cultural resources were separated according to the two major periods of human occupation: prehistoric and historic. In both cases, the archeological and archival data were quantified where possible to address specific research questions and hypotheses. The prehistoric sites were investigated in terms of settlement variability from both functional and evolutionary perspectives. The historic sites were examined in light of demographic, settlement, and land-use questions.

Judging by the presence of time-diagnostic artifacts, the prehistoric occupation of the project area extended from the Archaic Period through the Plains Apache of the eighteenth century. The research orientation was to conduct piece plotting of artifacts at each archeological site for purposes of studying intrasite and intersite variability. The data were organized as 59 quantified observations suitable for computer and statistical manipulation. Using a computer, research hypotheses dealing with functional, chronological, and evolutionary questions were tested. From these analyses two site types were defined: base camps and special-activity areas. It was found that the base camps tended to be located on the south bank of the Arkansas River near the stabilized dune fields, while the special-activity sites favored the north side of the river.

Most of the historic sites were farmsteads of ranch-related features which dated from the late nineteenth and early twentieth centuries. Quantitative techniques were utilized to examine data collected from both archeological observations and archival research. It was found that the project area was permanently settled by Euro-Americans mainly after 1880. The majority of these people were native-born Americans who came to the area to establish small livestock ranches or farms. This was a fairly stable rural region. Most of the land was locally owned and remained in the hands of one family over a significant period of time. Farmsteads tended to start out small, but grew in size over time as the economic necessity of farming or ranching larger tracts forced some landowners out, while giving others the opportunity to expand.

In terms of management goals, it was suggested that the prehistoric sites be addressed as a group and recommended for nomination to the National Register of Historic Places (NRHP) as a district. Only one historic site is deemed eligible to be nominated to the NRHP. That site, JM043, represents the remains of the townsite of Old Las Animas.

SECTION 2.0
INTRODUCTION

by Frank W. Eddy and Paul D. Friedman

Science Applications, Inc. (SAI) presents the following final technical report of the cultural resources inventory of the John Martin Dam and Reservoir, Bent County, southeastern Colorado to the Albuquerque District, Corps of Engineers (COE) in fulfillment of Contract No. DACW47-80-C-0002. This report discusses the methodologies employed during the fieldwork and analysis, describes the cultural properties which were located and recorded during the survey, interprets and analyzes the data collected in the field in terms of specific research questions and hypotheses, and offers evaluations and recommendations for the management of cultural resources within the project area. This work was performed to bring the COE into full compliance with various federal laws and regulations which require that cultural resources on all federally owned land be inventoried and evaluated in terms of the National Register of Historic Places (NRHP).

2.1 PROJECT BACKGROUND

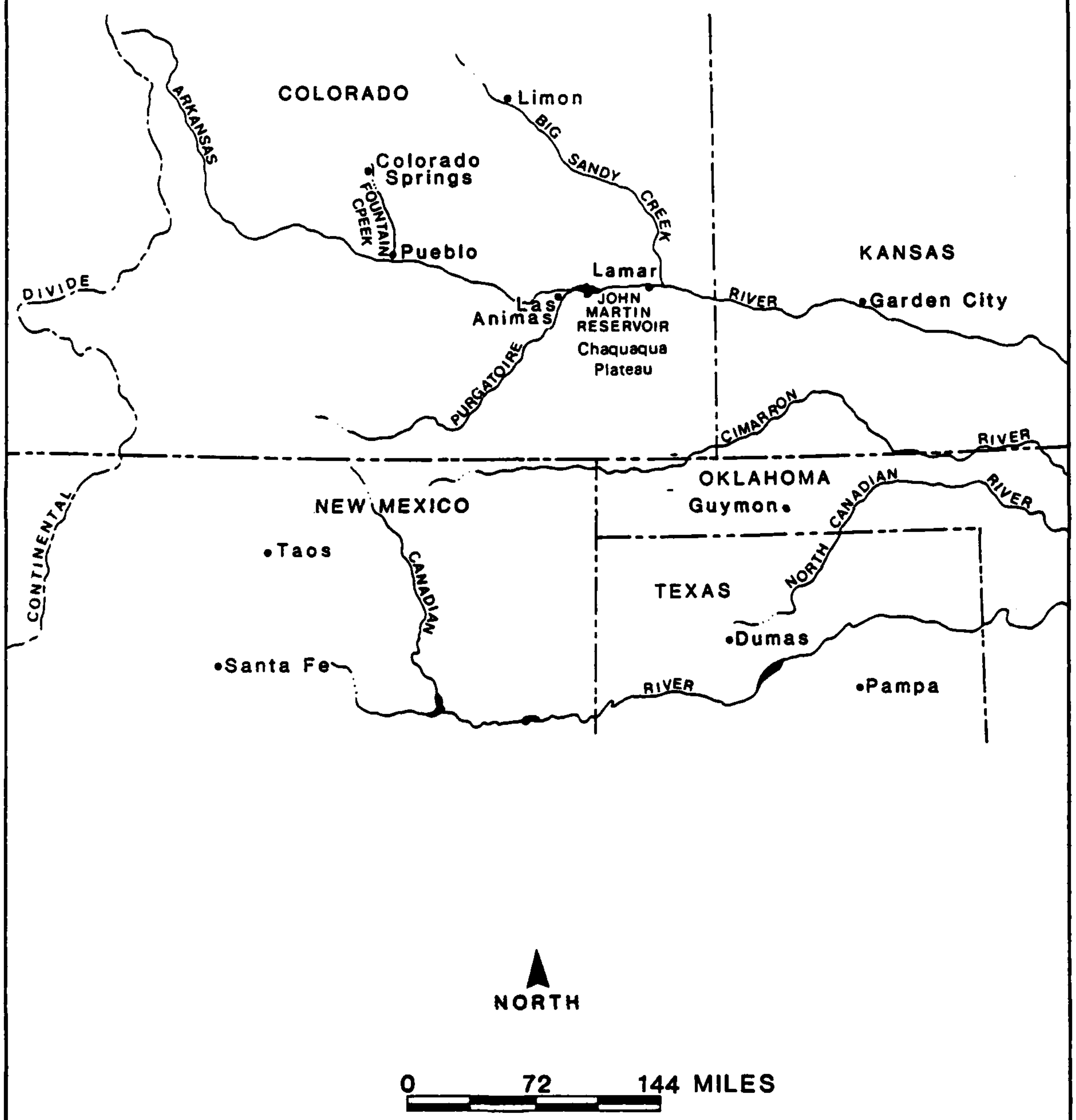
The John Martin Dam and Reservoir Project Area is located on the Arkansas River in Bent County, southeastern Colorado. It is situated approximately halfway between the towns of Las Animas and Lamar, about 58 miles west of the Kansas/Colorado border (Figure 2.1).The dam itself is a concrete gravity and earthfill structure with a gated spillway located in the concrete section. The John Martin Dam was authorized under the Flood Control Act of 1936, as amended by Congress in the Flood Control Act of 1938. Construction began in 1938, was delayed by World War II, and finally completed in October, 1948, at a cost of $15,233,366. Storage in John Martin Reservoir served the purposes of flood control, conservation of irrigation water, and retention of water-borne sediments.

The top of the flood control pool is 1172.7 m. (3,870 ft.) above mean sea level, and at maximum pool level about 7612.4 ha (17,630 acres) are inundated, creating a reservoir which covers 76236.3 ha/m. (621,326 acre ft.). When the reservoir is full it stretches 23.9 km (14.8 m.) long, with an average width of 3.1 km (1.9 m.), and has approximately 93.6 km (58 m.) of shoreline. The total project area contains about 10374.1 ha (25,624 acres), of which 8359.5 ha (20,648 acres) are owned in fee, while 2014.6 ha (4,976 acres) are easement lands. This project area includes the dam and reservoir, an administrative and maintenance area below the dam, a public use area focus around Lake Hasty on the opposite side of the river from the administration area, and a boundary area around the reservoir which serves various recreation and public use purposes. The entire project is administered by the Albuquerque District, Corps of Engineers (COE 1974,1976) (Figure 2.2).

2.1.1 PREVIOUS ARCHEOLOGICAL INVESTIGATIONS

There have been a few limited archeological surveys conducted around the John Martin Reservoir Project Area in the past. Charles Steen surveyed part of this region in 1933-1934 for the Colorado Archeological Survey. Also in the 1930s E. B. Renaud of the University of Denver made several surface reconnaissances in eastern Colorado. In 1954 Joe Ben Wheat of the University of Colorado Museum conducted a brief survey around the reservoir. The most recent work was a program to record prehistoric rock art sites in the area, done in 1971 by J. Randall for the Colorado Archeological Society. The site file search of the records of the Colorado Preservation Office revealed that there were 24 previously recorded archeological sites within the general region surrounding the project area. Within the confines of

FIGURE 2.1
REGIONAL MAP
JOHN MARTIN RESERVOIR PROJECT



BASE MAP SOURCE: National Geographic Society, July, 1976.

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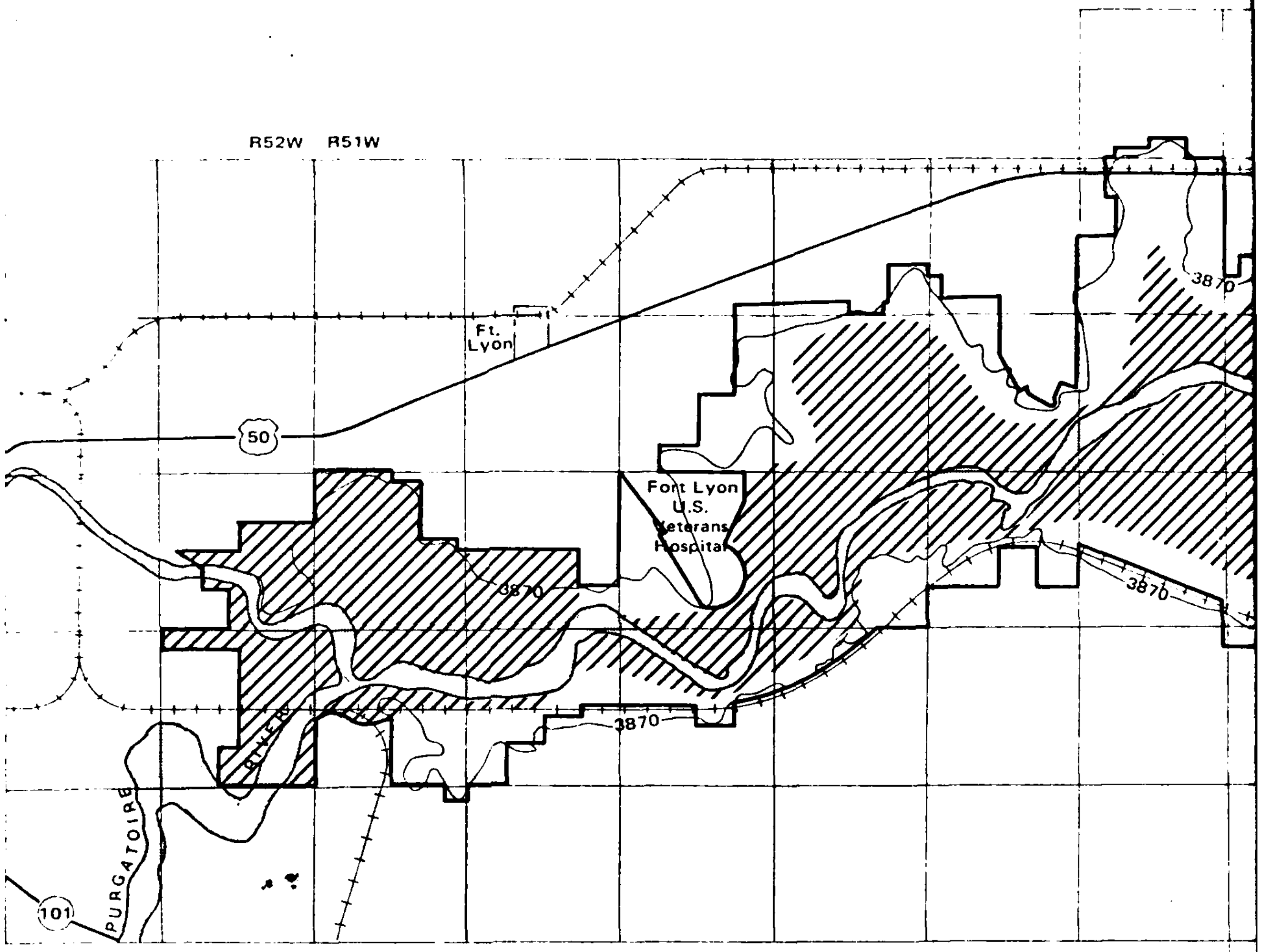
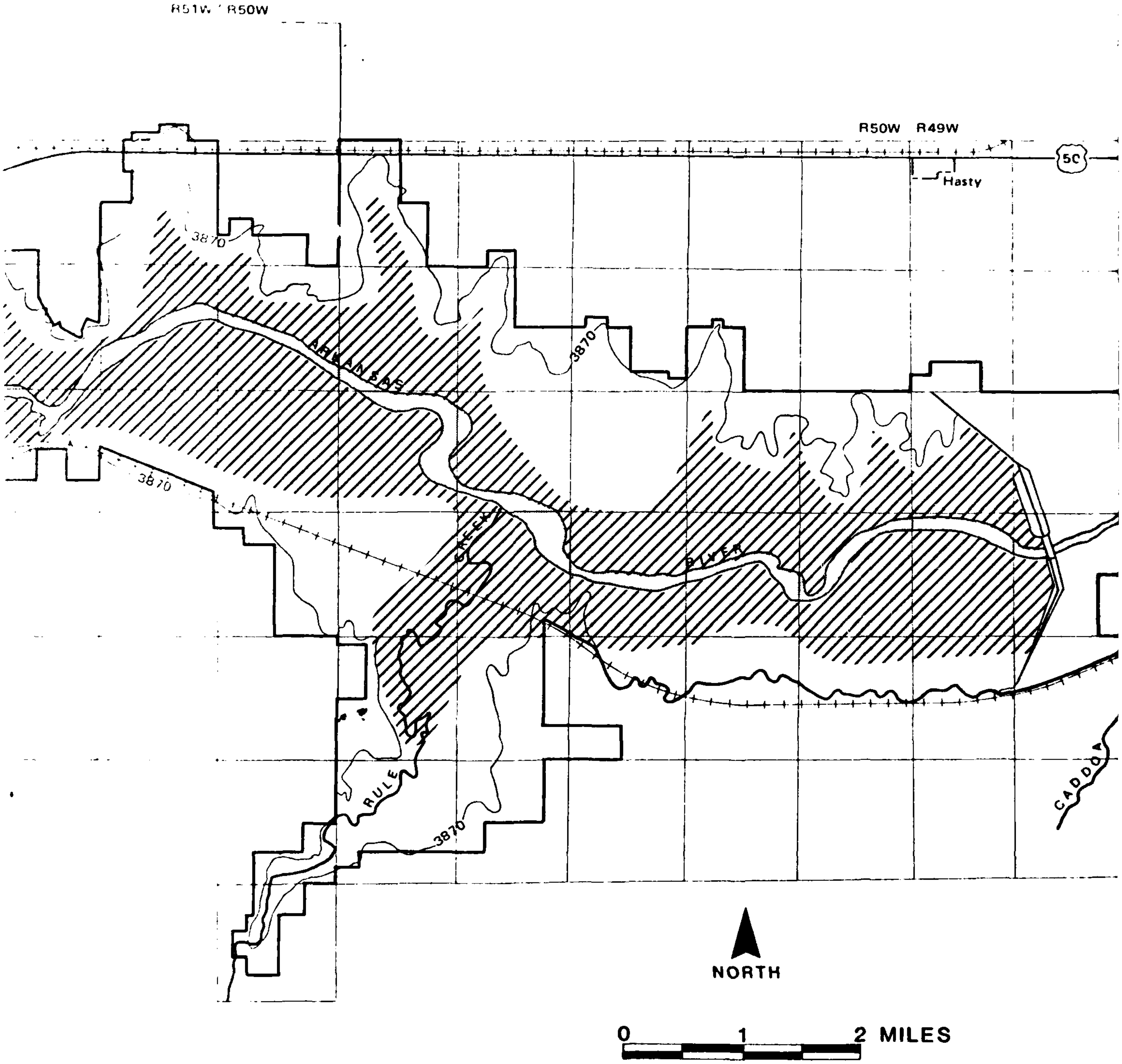


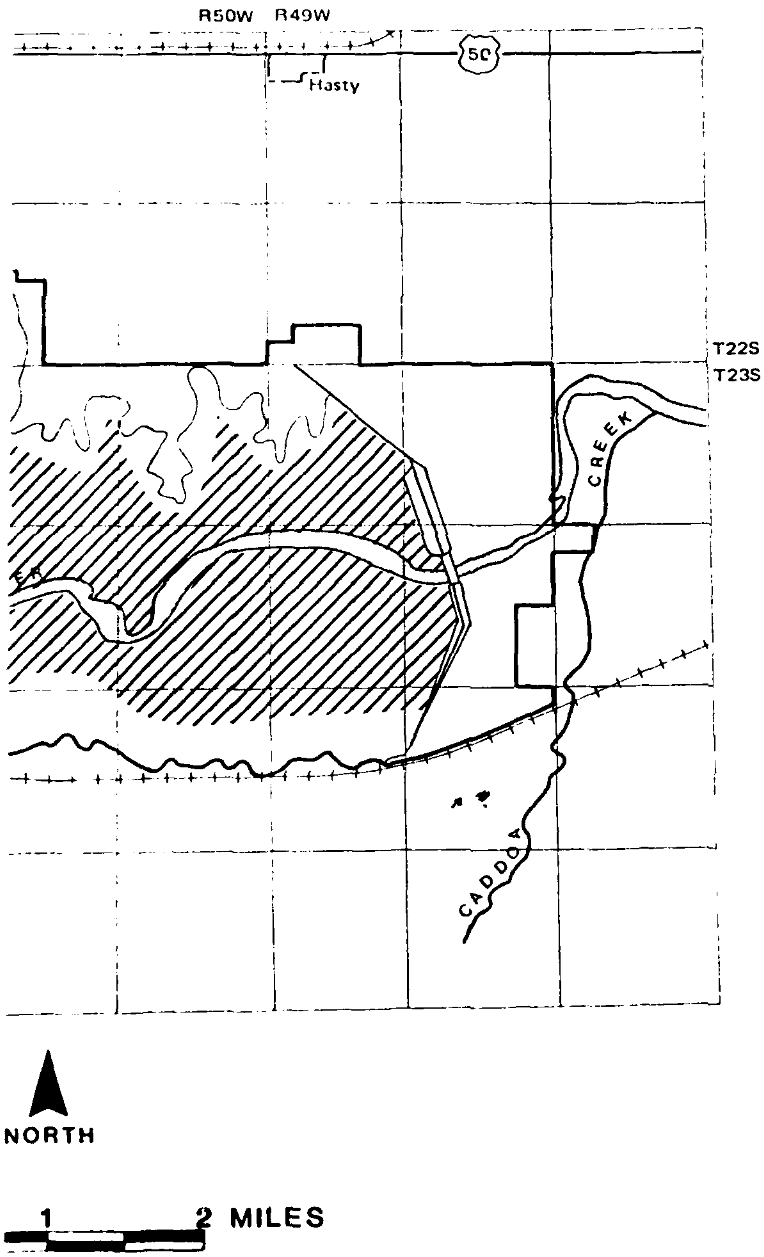
Study Area Boundary

Top of Flood Control Pool 3870

Unsurveyed Due to Reservoir, Silt or Marsh

FIGURE 2.2
STUDY AREA
JOHN MARTIN RESERVOIR PROJECT




R50W
R49W
50
Hasty
T22S
T23S
CREEK
CADDOA
NORTH
1
2 MILES

the reservoir boundaries itself, there were 20 previously recorded sites. These sites were noted as lithic scatters, campsites, stone circles, or rock art locations.

2.1.2 SAI INVESTIGATIONS

This report represents the completion of the third phase of the John Martin Reservoir Project cultural resources investigations conducted by SAI. The first phase of the project consisted of producing a planning document and took up the period from May to June, 1980. The planning document provided background information for the creation of a research design and the formulation of regional research questions and hypotheses pertaining to the project area. Much of this information has been utilized in this present document.

After the planning document was accepted by the COE, the field work phase of the project was initiated. This phase lasted from July to October, 1980. During the survey, 133 archeological sites were located and recorded. These sites consisted of 111 prehistoric components and 34 historic components. Twelve sites could be classified as double component properties, containing both prehistoric and historic remains. One hundred and three isolated finds were also recorded, which marked the location of minimal activity areas. Most of the isolated finds were prehistoric artifacts. Three sites were thought to have sufficient depth to require testing for subsurface remains. Of the 20 sites recorded by previous investigators, SAI was able to relocate and identify nine (Figure 2.3).

It was found that the prehistoric sites ranged in temporal terms from the early Archaic Period through eighteenth century Plains Apache encampments. The historic sites were mostly Euro-American farmsteads and ranch-related features dating from the late nineteenth and early twentieth centuries.

At the time fieldwork began, on July 18, 1980, the reservoir was filled to a capacity of 2425.1 ha (5,990 acres) due to a heavy spring runoff. For this reason, the initial part of the survey was begun just upstream from the dam, and could cover only the exposed portion of the project area between the right-of-way (ROW) boundary and the lake edge, which was then located at the 1,165.8 m (3,825.1 ft.) contour level. However, daily release for downstream water commitments continued to widen the dry-strip of land available for survey as the waterline receded at a rate of approximately 30.77 cm per day during the fieldwork. By September 19, 1980 when the pedestrian survey was completed, the water stood at 1,159.2 m (3,803.4 ft.) in elevation, to form a lake with a surface area of 1429.1 ha (3,530 acres); a reduction in the reservoir level of 5.1 m (16.7 ft.).

Other impediments to survey coverage were areas of wetland marsh and heavily silted areas resulting from the operation of the dam and reservoir over the last 30 years. The scope-of-work put out by the COE estimated that approximately 1113.6 ha (2,800 acres) immediately above the dam would be too heavily silted to survey, as well as about 1036.4 ha (2,560 acres) or marshlands. The silted regions and marshlands included the lower portions of Rule and Gageby Creeks, and the upper end of the reservoir near the town of Las Animas (Figure 2.2).

Although the contract stipulated survey coverage of 10374.1 ha (40 sq. mi.) of fee and eastment lands, the areas covered by the lake, silt, or marsh reduced the actual surface available for inspection to about 6276.9 ha (24.2 sq. mi.), calculated from an average reservoir size of 1927.1 ha (4,760 acres). The loss of survey acreage due to the fill of the reservoir, silt, and marsh skewed the data that was obtainable during the survey. Absent from the survey data were any sites located along the river behind the dam, in the area at the upper end of the reservoir,

FIGURE 2.3 LIST OF PREVIOUSLY RECORDED SITES IN THE JOHN MARTIN RESERVOIR PROJECT AREA

Colorado Preservation Office Number (Smithsonian System)	SAI Temporary Number (If Relocated)	Site Type/Recorder
5BN001	Not relocated	Stone Circles found by Wheat in 1954.
5BN002	JM007	Lithic Scatters on the bluffs on north side of Arkansas River. Wheat, 1954.
5BN003	JM099	Campsite and Quarry. Wheat ,1954.
5BN007	JM128	Hicklin Springs Pictograph Site. Called Site No. K by Steen, Site No. 32-A, 32-B of Renaud. Wheat gave it 5BN007. Randall called it 5BN117. Renaud's site labeled 5BN099 by Colorado Preservation Office.
5BN008	JM130	Surface Campsite in dune blowout. Wheat, 1954.
5BN014	JM104	Campsite. Steen labeled it Site No. W. Renaud called it Site No. 364. Wheat gave it 5BN014. Colorado Preservation Office listed Renaud's site as 5BN112.
5BN098	Not relocated, under water?	Renaud called it Site No. 30. Renumbered 5BN098 by Colorado Preservation Office.
5BN099	JM128	Same as 5BN007.
5BN101	JM038	Lithic Scatter. Called Site No. A by Steen, No. 235 by Renaud.
5BN102	Not relocated, near JM032	Stone Circle. Called Site No. AD by Steen, No. 395 by Renaud.
5BN103	Not relocated, could be considered part of JM128/5BN007	Pictographs on west side of Rule Creek, across from Hicklin Springs. Recorded erroneously as "Hackberry Springs" by Amer, 1950. Could be included in 5BN007. Same as Renaud 32-B.

Figure 2.3 - continued

Colorado Preservation Office Number (Smithsonian System)	SAI Temporary Number (If Relocated)	Site Type/Recorder
5BN111	Not relocated	Camp, with manos and metates. Called Site No. H by Steen, No. 284 to Renaud.
5BN112	JM104	Campsite, same as 5BN014.
5BN114	Not relocated	Rock Art Site. Recorded by Randall in 1971.
5BN117	JM128/5BN007	Hicklin Springs Pictograph Site. Renumbered by Randall, 1971.
5BN118	JM077	Rock Art Site/Rock Shelter. Recorded by Randall, 1971.
5BN121	JM059	Rock Art and Camp. Recorded by Randall, 1971.
5BN122	JM117	Rock Art and Camp. Recorded by Randall, 1971.
5BN126	Not relocated	Rock Art Site. Randall, 1971.
5BN132	Not relocated	Camp. Hubbard, 1978.

the lower reaches of northern tributaries to the Arkansas River, and the floodplain in lower Rule Creek. For example, the old townsite of Caddoa, known to be located on the south bank of the Arkansas just upstream from the damsite, could not be relocated or recorded because it never appeared above the lake surface.

The last phase of the John Martin Reservoir Project was the analysis of the data collected during the fieldwork and the production of this report.

2.2 RESEARCH GOALS AND OBJECTIVES

The John Martin Reservoir Project had as its central mission the development of a realistic problem-oriented research design for the structuring of scientific investigations and the management of cultural properties within the reservoir boundaries. The research design guided the manner in which cultural resources within the project area were located, recorded, and identified. It also provided a framework for the analysis of those cultural resources so that important regional research questions could be addressed. The objectives of this report are to describe the cultural resources located during the survey, evaluate those resources in terms of the criteria used for the nomination of properties to the NRHP, identify possible sources of adverse impact to those cultural properties, and recommend strategies for the future management of those resources. This report should provide the COE with a tool to be used for the management of cultural resources within the John Martin Reservoir project area, as well as making a meaningful contribution to scientific inquiry.

It is important to note that the prehistoric and historic discussions are handled separately in this report. This is because of differences in the two kinds of data bases and the way they are treated. While both prehistoric and historic sections follow a similar format, the data were addressed in different manners. The prehistoric investigations used the scientific methods of theoretical models and hypotheses testing to formulate suppositions about past human behavior. The historic investigations relied more heavily on narrative explanations based on archival, as well as archeological, sources. There is no corresponding archival source material for prehistoric sites and, thus, the archeological information must stand alone. Artifactual evidences, features, and site remains of prehistoric occupation represent craft-industry products generated by small, local, closed cultural systems of band and tribal aboriginal existence. The investigative procedures used to study such remains are quite different from those needed to research Euro-American historic sites marked by industrial machine-made artifacts generated by commercial institutions and communities economically keyed to an open system international scene. For these reasons, the problem orientation of the prehistoric study focused on functional and evolutionary investigations, while the historic research dealt with questions concerning settlement patterns, land use, and demography. Both prehistoric and historic studies attempted to quantify the data, where possible, for statistical analyses using the University of Colorado CDC Cyber 172 computer. However, the prehistoric investigations were more concerned with scientific explanations, while the historic section approached the data from a humanistic viewpoint.

The research orientation for the prehistoric sites led to piece plotting of individual artifacts for purposes of studying intrasite and intersite variability. The data was organized as 59 quantified observations so that the theoretical models and hypotheses posed in the research design could be tested through computer and statistical manipulation. Programs employed include the Statistical Package for the Social Sciences (SPSS), an original Nearest Neighbor routine, a Z-coordinate cluster mapping procedure, and Numerical Taxonomic System (NTSYS). Using these computer programs,

the data was examined in terms of functional, chronological, and evolutionary research questions. Six functional hypotheses dealing with the networking of settlement site types were addressed during the analysis phase. It was found that two site types, base camps and special-activity areas, could be defined. The fact that few sites yielded reliable chronological information hindered the examination of the evolutional hypotheses. For the few dateable sites that were found, the majority showed the predicted formal clustering by time period. Twelve environmental variables were used to predict site density. Here a Regression model was used to check the consistency of the distribution of sitetypes over the project area. This report formally organized the information as a Prehistoric Research Design (Section 4.0), Description of the Prehistoric Survey Data Base (Section 5.0), and Analysis and Evaluation of Prehistoric Hypotheses (Section 6.0)

The organization of this historic material follows a similar format. However, the style of the presentation of the data differs from the prehistoric sections to reflect the different approach to the subject. Again these are an Historic Research Design (Section 7.0), a Description of the Historic Survey Data Base (Section 8.0), and the Analysis and Evaluation of Historic Hypotheses (Section 9.0). The data collected from the historic sites was treated as a block sample to be used to formulate generalizations about human occupation in the region in recent times. Research questions dealing with such topics as chronology, function, ethnicity, and wealth were addressed using both archival and archeological evidence. In testing the research hypotheses it was found that the archival information could be used to examine such problems as settlement patterns, land-use, and demographic change. The statistical analysis of artifact types found at the historic sties was used to group sites with similar frequencies of material goods. The relationship between site location, function, and environmental variables was also examined. The generalizations produced through the statistical analysis could then be compared to the narrative historiography presented in the Historic Regional Overview (Section 7.1), to see if what historians think happened in the area corresponds to actual trends.

The results of these analyses, both prehistoric and historic, are then summarized in Section 10.0. This section, along with Section 11.0, offers site management recommendations and evaluations of the cultural resources within the John Martin Reservoir project area.

2.3 ACKNOWLEDGEMENTS

The success of the John Martin Reservoir Project must be attributed to the hard work and contributions of a large number of people. A special debt of gratitude is owed to the COE, Albuquerque District. Donna Roxey, District Archeologist, and Jan Biella, Archeologist, put together an innovative scope-of-work that allowed pure research and resources management to go hand-in-hand. Their ideas and support were greatly appreciated. Further thanks for cooperation are extended to Russell Smith, Resident Superintendent of the John Martin Reservoir, who was extremely helpful in supplying information and arranging local contacts.

Also of great assistance were the various Bent County officials who kindly allowed us to rummage through their old documents. Special thanks to Donetta Davidson, County Clerk; Ben Lacy, County Assessor; and Jerry Bryant, County Abstractor. Several local informants provided their views of the history of the area, including Dorothy Boyd and Harold Sorensen, both of Las Animas. Other information on local history was obtained through Hallie Bond and Bill Sedgefield of the Kit Carson Historical Museum in Las Animas.

Tom Dooley, Systems Analyst with INFOMAP Company wrote the programs which

producted the Z-coordinate and pin maps for each archeological site.

Within SAI, many people should be mentioned for their contributions to various phases of this project. Dr. Frank W. Eddy served as Principal Investigator on the project. Dr. Eddy personally supervised the pedestrian survey from July 16 to August 19, 1980, and acted as the major author of the prehistoric sections in both the planning document and this report. T. Reid Farmer was the Project Coordinator, and after Dr. Eddy left the field, Farmer assumed the role of supervisor for the completion of the survey and the testing program which lasted until early October 1981. Dr. James E. Fitting served as the first Project Manager. Paul D. Friedman was the Project Historian and took over as Project Manager in charge of report production in June 1981. During the field session, three rotating crews of professional archeologists were employed. Gary L. Moore, Richard Carrillo, Chris Jurgens, and Dennis L. Dahms all served as Crew Chiefs at one time or another. The field crew members consisted of T. R. Farmer, Constance E. Farmer, J. Jan Reining, Paul D. Friedman, Dale L. Wedel, Claudia Hemphill, Richard E. Oberlin, Richard D. Hurt, Beverly Leichtman, and Jeff Campbell.

Laboratory analysis and report writing began in October 1980 and ran through June 1981. J. Jan Reining and Beverly Leichtman were responsible for cataloguing the artifacts and coding the data sheets. Richard Oberlin was in charge of all of the computer processing of the data, both prehistoric and historic. Sections 12 and 13 on the geology of the project area were written under sub-contracts by consultants Vance T. Holliday of the Department of Geology, University of Colorado, and Judith Van Couvering of the University of Colorado Museum and, thus, these sections appear as appendices to this report. Graphics were drawn and produced by Connie Farmer and Marina Ossipov. Word-processing was done by Debbie Patterson, Carolyn Conner, Valerie Reusink, and Esther Goodyear. The draft of this report was completed in July 1981. After a period for review and comment, Dr. Asha Kalia revised and edited the final edition.

This report reflects a team effort. But as is the case with many reports with multiple authors, it is often difficult to assign exact credit for specific sections, especially after editing and revisions. In general, Frank W. Eddy wrote the majority of the prehistoric section and Paul D. Friedman wrote the entire historic sections. On a more specific level, Dr. Eddy was responsible for Sections 3.3, 3.4, 3.5, 4.2, 4.3, 4.4, 5.1, 5.2, 5.4, 5.6, 5.7, 5.8, most of 6.0, 10.1, 10.2, 10.3, and a good part of 1.0, 2.0 and 11.0. Paul D. Friedman wrote Sections 1.0, 2.0, 3.1, all of Sections 7.0, 8.9, and 9.0, and part of Sections 10.0 and 11.0. Richard E. Oberlin made a significant contribution to Section 6.0. T. Reid Farmer wrote Section 4.1. Dennis L. Dahms wrote Section 3.2. J. Jan Reining wrote Section 5.3. Beverly Leichtman contributed Section 5.5.

The project administrators are grateful to those named above, and to the many others not mentioned who contributed to the production.

SECTION 3.0
ENVIRONMENTAL DISCUSSION

by Paul D. Friedman, Dennis E. Dahms, and Frank W. Eddy

In order to study past adaptive practices, both present and past environments must be understood. Present environmental variables provide a data base for understanding the range of variation possible within certain time periods of the past. In this fashion, the present can be said to mirror the past, to serve as an analog model from which hypotheses are derived for testing against paleo-environmental data. However, it must be kept in mind that there may be environments of the past for which there are no modern analogs. For instance, the last 5,000 years of the Neoglacial Period have been described as a climatic interval like that of the present. It is likely, then, that the Neoglacial environmental variation is accurately mirrored in the present so that reasoning by analogy is appropriate. In contrast, however, it does not seem likely that quite different environments of the past, such as the *Altithermal*, *Deglaciation*, or late Glacial times, are faithfully mirrored in the present, pre-dam John Martin ecosystem. For these reasons, environmental analogs for ancient past environments must be sought outside of the Reservoir District.

The purposes of this section, then, will be three-fold. First, will be to provide a general description of the modern environment taken from both archival sources and environmental records. Second, will be a description of past environments as interpolated from paleoenvironmental and geological events. Lastly, will be a discussion of the environmental variables which will be used in the analyses to follow.

3.1 HISTORIC ENVIRONMENT

The following narrative describes the past environment of the John Martin Reservoir area in terms of the historic literature. Through the chronicles of the first Euro-American explorers to visit the region it is possible to examine how the Arkansas River Valley was perceived, and how the historic environment compared to both the ancient and the modern environment.

The Spanish, venturing out of Mexico, were the first peoples of European descent to visit and describe the region around the John Martin Reservoir. In 1540 Francisco Vasquez de Coronado led an expedition northward in search of the legendary Seven Cities of Cibola. His army crossed New Mexico, the panhandle region of Oklahoma and Texas, and into modern-day Kansas, arriving at the village of Quiriva. Although he did not pass through the project area, Coronado was the first to leave a written account of his impressions of the Great Plains. "I came upon some plains so vast in my travels I did not reach their end, although I marched over them for more than three hundred leagues," he wrote (Bolton 1949:245). Another of his party recorded that:

> Travelling in these plains is like voyaging at sea, for there are no roads other than cattle (buffalo) trails. Since the land is so level, without a mountain or a hill, it was dangerous to travel alone or become separated from the army, for on losing sight of it one disappeared. Thus we lost one man, and others while out hunting were lost for three or four days (Bolton 1949:255).

The Spaniards gazed upon the huge herds of buffalo with wonder. One wrote:

> The country where these animals roamed was so level and bare that whenever one looked at them one could see the sky between their legs, so that at a distance they looked like trimmed pine tree trunks with

the foliage joining at the top. When a bull stood alone he resembled four such pines. And however close to them one might be, when looking across their backs one could not see the ground on the other side.... This was because the earth was so round, for, wherever a man stood, it seemed as if he were on the top, and saw the sky around him within a crossbow shot. No matter how small an object was placed in front of him, it cut off his view of the ground.... There are no trees except along the streams found in some barrancas, which are so concealed that one does not see them until he is at their very edge. They are of sand and gravel, with trails made by the cattle (buffalo) in order to reach the water which flows quite deep (Bolton 1949:254).

Although Coronado was disappointed to discover that Quivira was not a golden city, he was favorably impressed with the land, comparing it to Spain. In a letter to the king he wrote:

> The country itself is the best I have ever seen for producing all the products of Spain, for besides the land itself being very fat and black and being very well watered by the rivulets and springs and rivers, I found prunes like those of Spain and nuts and very good sweet grapes and mulberries (Webb 1931:107).

One of Coronado's captains, Jaramillo, also thought this a bountiful region, reporting:

> This country presents a very fine appearance, than which I have not seen a better in all our Spain nor Italy nor part of France, nor indeed, in the other countries where I have traveled in His Majesty's service, for it is not a very rough country, but is made up of hillocks and plains, and very fine appearing rivers and streams, which certainly satisfied me and made me sure that it will be very fruitful in all sorts of products. Indeed, there is profit in the cattle (buffalo) ready to the hand, from the quantity of them, which is as great as one could imagine. We found a variety of Castillian prunes which are not all red, but some black and green; the tree and fruit is certainly like that of Castile, with a very excellent flavor (Ibid).

However, for over 40 years after Coronado's return, the Spanish were more concerned with affairs in Mexico than in chasing vainly after rumors of treasure beyond the northern frontier Eventually the threat of foreign incursions on territory claimed by Spain, and the desire to conquer and christianize the pueblo Indians, led to the establishment of a Spanish colony in New Mexico by Juan de Onate in 1598. In 1601 Onate set out from New Mexico in search of the South Sea. Making his way to the Arkansas River, Onate's company traveled as far as Quivira. In his account of this expedition, Onate recorded his impression of the Arkansas River Valley.

> They guided us to a river (the Arkansas), seven leagues from this place, with wonderful banks, and, although level, so densely wooded that the trees formed thick and wide groves. Here we found a small fruit the size of the wild pear or yellow sapodilla, of very good flavor. The river contained an abundance of very good fish, and although at some points it had good fords. in other parts it was extremely deep and vessels could sail on it with ease. It flowed due east, and its waters were fresh and pleasant to taste. Here the land was fertile and much better than that which we had passed. The pastures were so good that in many places the grass was high enough to conceal a horse (Bolton 1908:258).

In 1680 the pueblo tribes revolted and drove the Spanish out of New Mexico. Between 1692 and 1696 Diego de Vargas recaptured the region, and many pueblo Indians fled northward. In

1706 Juan de Ulibarri set out on an expedition to return the pueblo Indians, who he heard were being held captive by the Apache at El Cuartelejo in present day Kansas. Ulibarri's route took him to the Arkansas River, near what is now the city of Pueblo. In his diary of the expedition, Ulibarri noted that the Indians called the river the Nepestle. He wrote:

> It runs from north to east. It is much more than four times as large as the Rio de Norte and bathes the best and broadest valley discovered in New Spain. It has many poplar trees and throughout the upper part most beautiful open stretches. The plain on our side is a strand of a long league of level and extremely fertile as is shown by the many plums, cherries, and wild grapes which there are on it (Thomas 1935:66).

At El Cuartelejo, Ulibarri met with the Apache and gathered together the pueblo Indians for their return to New Mexico. Ulibarri was impressed with the Apaches, with their inclination towards permanent settlement, and their acceptance of Spanish protection and Christianity. He also was impressed with the fine soil and the agricultural endeavors of the natives. "The second thing I notice," Ulibarri wrote, "was the great fertility of the land and its good climate, for at the end of July they had gathered crops of Indian corn, watermelons, pumpkins, and kidney beans" (Thomas 1935:72-73).

The Apaches had told Ulibarri of attacks upon them by Utes and Comanches. The raids of these tribes worried the Spanish authorities in New Mexico. In 1719 the governor of New Mexico, Antonio de Valverde, personally led an expedition against the Utes and Comanches on the northern frontier. Following Ulibarri's route most of the way, Valverde's party reached the Arkansas River just east of La Junta, near the John Martin Reservoir project area. In his diary, the governor noted how pleasant the physical surroundings were. He wrote:

> Having marched some ten leagues they arrived at the Rio Nepestle (Arkansas), which is a very copious and pleasant river, with many poplars and extensive flatlands. On these latter there were great herds of bison so that in the distance they looked like rolling hills. From what the plains men (Apache) said, more than eight thousand head could be seen. Here much meat was secured by killing them (Thomas 1935: 129).

Although the Spanish debated establishing a presidio on the Arkansas River at El Cuartelejo, this was never accomplished. In fact, with the exception of several other exploratory expeditions, the Spanish left the northern frontiers of New Mexico alone. Their impressions of the region, however, remained consistent from the time of Coronado to Valverde. The Great Plains and the area along the Arkansas River were viewed as a fertile land, which might one day support settled communities of native tribes. These tribes would be Christianized and loyal to the Spanish authorities, thus acting as a buffer against further intrusions from the French.

The fear of the French was erased in 1762 when France ceded the territory west of the Mississippi River to Spain. Louisiana was reacquired by France in 1800, and in 1803 this vast tract of land was purchased from Napoleon by the United States.

To explore the southwestern boundary of the new purchase, the United States sent out a small expedition under the command of Lieutenant Zebulon Montgomery Pike in 1806. Pike's party traveled down the south side of the Arkansas River through the project area. On November 15, 1806 he wrote in his journal, "Marched early. Passed two deep creeks and many high points of the rocks; also, large herds of buffalo." According to his maps, this put Pike within the John Martin Reservoir project area. The two creeks he crossed were Caddoa

Creek and Rule Creek. At this point, some seven miles east of the Purgatoire River, Pike caught his first glimpse of the Rocky Mountains. By venturing into Spanish territory, however, he exceeded the bounds of his mission. Pike and his men were arrested by Spanish troops, escorted to Mexico, and then released.

The major contribution of the Pike expedition was that it opened a new region for American exploration. Pike's journal, published in 1810, was the first American account of this area, and it colored the perception of the Great Plains for a generation to come. Some scholars have argued that Pike's original impression of the plains had been a favorable one. In his journal he usually referred to the plains as "prairie." By the time he published in 1810, however, several factors combined to change Pike's opinion about the region. His implication in the Burr-Wilkinson scheme to split off the southwestern portion of the Louisiana Purchase from the United States probably influenced Pike to reevaluate his initial favorable impression of the area. Perhaps to disassociate himself from the Wilkinson faction, he painted a negative view of the plains (see Allen in Blouet and Lawson 1975). In his now famous discussion of the soils and rivers of Louisiana published in the "Appendix to Part II" of his 1810 work, Pike wrote:

> ....In that vast country of which we speak, we find the soil generally dry and sandy, with gravel, and discover that the moment we approach a stream, the land becomes more humid with small timber ....But here a barren soil, parched and dried up for eight months of the year presents neither moisture nor nutrition sufficient to nourish timber. These vast plains of the western hemisphere, may become in time equally celebrated as the sandy deserts of Africa for I saw in my route, in various places, tracts of many leagues, where the wind had thrown up the sand, in all the fanciful forms of the ocean's rolling wave, and on which not a speck of vegetable matter existed (Jackson 1966, Vol. 2:27).

Pike softened his view somewhat when referring to the region just west of the project area. Describing the country along the Arkansas River west of the Purgatoire River, Pike observed:

> From the first south fork (the Purgatoire River) the borders of the river have more wood, and the hills are higher, until you arrive at its entrance, into the mountains (at Royal Gorge). The whole of the timber is cotton wood, from the entrance of the Arkansaw, in the mountains, to its source, a distance of about 170 miles; (by the meanders) it is alternately bounded by perpendicular precipices in small narrow prairies, on which the buffalo and elk have found the means to arrive, and are almost secure from danger, from their destroyer - Man (Jackson 1966, Vol. 2:24).

The next group of Americans to visit the project area and record their impressions of the physical surroundings was the military expedition headed by Major Stephen H. Long. As part of the so-called "Yellowstone Expedition," Long was responsible for leading a scientific detachment to the Rocky Mountains and reporting about the region. The Long group traveled up the Platte River, to its South Fork, then turned south to the Arkansas River. While heading down the Arkansas, the company split into two groups, near the present location of Rocky Ford. One group, under the command of Major Long, went to explore the Red River (the Canadian it is now called). The other group, led by Captain John Bell, continued east along the Arkansas River. Reaching the Purgatoire River, Bell recorded:

> ....It appears to be the largest fork we have passed, having wide bottoms and a fine growth of cotton wood on the margin of the

banks, it comes from the south west, running almost parallel with the river for some distance above its confluence - high sand hills and bluffs marks its course for 10 to 15 miles from the river. At its junction with the river (the Arkansas) are beautiful bottoms and plains for some distance above and below, luxuriant soil-producing abundance of grass increase, many of them timbered. Six miles further and we arrived at a precipice and bluff of rocks, made up of different species, the principal was sandstone - from the summit of these we discovered at a great distance on the prairie a herd of buffalo feeding (Fuller and Hafen 1957:189).

The next day, July 26, 1820, Bell made further reference to the environment of the project area, writing:

...The rocky hills & knobs continue on this side of the river about 10 miles, on the opposite side an extensive bottom & undulating prairie as far as the eye sight extends. These rocky bluffs above the plain, are from 20 to 60 feet, their surfaces covered with thin soil - on a number of the bottoms, between the bluffs and the river are considerable groves of cottonwood trees, thinly scattered, soil good producing abundance of grass. The isleands in the river are increasing in size as also the timber growing on them (Fuller and Hafen 1957:190).

It is clear from Bell's journal that he was describing the region encompassing the project area at that point. He seemed favorably impressed with the abundance of grass and cottonwood trees along the river bottoms. The sight of sandstone bluffs and undulating prairie greets the modern visitor to this locality just as it was seen by Bell over 160 years ago.

The specific details of the environment of the project area aside, the Long expedition did not return to the United States with a favorable view of the Great Plains. Dr. Edwin James, the official chronicler of the Long expedition, was particularly harsh in his description of the area as a whole. In his account, published in 1823, James introduced one section on mineralogy and geology with the phrase "The Great Desert at the Base of the Rocky Mountains." With a now famous flourish of his pen, James wrote:

In regard to this extensive section of country, I do not hesitate in giving the opinion, that it is almost wholly unfit for cultivation, and of course uninhabitable by a people depending upon agriculture for their subsistence. Although tracts of fertile land considerably extensive are occasionally to be met with, yet the scarcity of wood and water, almost uniformly prevalent, will prove an insuperable obsticale in the way of settling the country (Thwaites 1905).

To illustrate the point graphically, the map of the United States drawn up by the Long expedition showed the plains as the "Great Desert." American cartographers for many years afterwards were influenced by Long's designation for the region, and maps of the period reproduced the label of the Great American Desert for the plains.

Not all Americans who had the opportunity to view the plains thought it uninhabitable. An expedition of dragoons led by Colonel Henry Dodge in 1835 marched up the Platte River, then south to the Arkansas River and took careful notice of the many native tribes living in the region. Dodge also noted the local topography. Of the Arkansas River Valley between the mountains and Bent's Old Fort, he wrote:

This portion of the valley of the Arkansas possesses many of the general features of the valley of the Platte. Its width,

> which is variable, is almost the same and terminated like the Platte by a range of hills of variable height. The soil near the river is composed mostly of clay, but further back upon the high praire it consists of dry, hard sand or gravel. The terminating ridge of the valley is not continuous, but divides into detached hillocks, some of them resembling haystacks, others more elongated. The general level of the valley appears to be much lower than that of the Platte, the timber more abundant, and of a larger growth. Crossed several dry creeks. some of them skirted with timber. The country between this and the Platte is said to be hilly with but little timber and water. The buffalo are very numerous in that portion of the country, and the Indians frequently move their whole villages there, and remain and hunt there for a considerable length of time (Dodge 1836:140).

Dodge stopped at Bent's Old Fort and held councils with various tribes. Upon leaving the post and heading east along the Arkansas River, he made additional observations about the terrain.

> Continued our march down the Arkansas. The valley continued to retain the same general appearance it possesses above; the timber, however, less abundant than heretofore, the soil more fertile, and the valley a little narrower. The terminating ridge of the valley seems at this place to be composed of regular layers of rock superimposed upon each other. They appeared to be mostly sandstone, of a fine texture. The debris of the rocks appears to be of various sorts and species. Saw no buffalo, but discovered recent traces of them. The country back from the river between this and the Platte is mostly a high prairie, in some places rough and uneven, in others perfectly level. There is but little timber and a great scarcity of water. Some of the creeks, however, we passed, which are dry at the mouth, are said to contain some water near their source. The distance across the country from the Arkansas to the Platte is said to be from one hundred to one hundred and twenty miles and the buffalo numerous (Dodge 1835:142).

One of Dodge's men, Captain Lemuel Ford, also kept a journal of the expedition. Upon reaching the Purgatoire River, Ford recorded, "We traveled over a poor gravelly country very much the same for the last hundred miles timber on the river in places cottin wood" (Pelzer 1926:568).

Because of these military expeditions to the area, Americans were learning more about the Great Plains. One explorer in particular played an important role in giving the country a new perspective about this region. Between 1842 and 1848 John Charles Fremont led four expeditions to the far west, creating a national reputation for himself. His accurate observations and maps helped to break down worn-out misconceptions about the plains. On his third expedition to the west, Fremont traveled up the Arkansas River, across the project area, to Bent's Old Fort. His instructions directed that he study "the geography of localities within reasonable distance of Bent's Fort and of the streams which run east from the Rocky Mountains." However, Fremont had more ambitious plans, and the expedition ended up in California, where he took an active part in the Mexican-American War. In his *Memoirs,* Fremont overlooked the geography in the vicinity of the project area in favor of a strong narrative of his adventures on the way to fame in California. One of his men, however, did leave a detailed description of the region near present-day John Martin Reservoir. At Bent's Old Fort, Fremont split off part of his company, under the command of Lieutenant J. W. Abert, with instructions to proceed up the Purgatoire River and survey the Red and Canadian Rivers. Abert's account of this detachment gives a glimpse of his

opinions about the environment between Bent's Old Fort and the mouth of the Purgatoire River. Wrote Abert:

> ....Our route lay along the right bank of the river (south side of the Arkansas); one continued series of hills and sand plains. We noticed a profusion of praire sage, "artemisca tridentata,'" being about the only shrub that grows in these sandy regions. This plant seems to love a dry and arid soil, covering, as it does, millions of acres of the great desert at the eastern base of the Rocky mountains. In some places it grew so luxuriantly that the stalks might be used for fuel. We were disappointed in not seeing even one specimen of the sage cock, "tetrao upophrasianus," which is so extravagantly fond of feeding on this plant that its flesh becomes so embittered as to render it perfectly uneatable. Norwithstanding the abundance of the plant, we did not see a single specimen of this bird during the trip. Cacti were numerous, and a species of cucurbitaceae, "cururbita aurantia," bearing a small spherical gourd, orange-colored. These plants are characteristic of the dry sandy plains. As we moved along, some deer sprang from the dead tangled wild wood of the Arkansas bottom, and antelopes dashed across the praire much to our astonishment, for we supposed they had become almost extinct in the vicinity of the fort (Abert 1941:20).

Abert's description of the region near the John Martin Reservoir is similar to what the area looks like today. On the south side of the Arkansas River sand dunes are still prominent geographic features. Abert was influenced by previous expeditions to the region, and, like Pike and Long before him, referred to the area as a "great desert." Old conceptions die hard.

But gradually American opinions about the Great Plains did change. Emigrant traffic along the Oregon and California trails, the building of the transcontinental railroad, and other factors contributed to the public's knowledge about the region, and opened it up for settlement. Eventually the Great Plains became viewed as an open range for livestock raising. People realized that if bison could thrive on the plains, so could cattle. After the Homestead Act of 1862, farmers ventured into the plains. Because of its arid climate, technological innovations had to accompany the shift to agriculture. Inventions such as *barbed wire, windmills, dry-farming methods, and* irrigation, went hand in hand with the spread of agriculture on the plains (Webb 1931).

These trends occurred within the John Martin Reservoir project area, much as they happened elsewhere on the plains. The open-range cattle industry was the dominant activity until the 1880s. In the late 1880s and early 1890s irrigation projects aided agricultural development. From the turn of the century until today, ranching and farming remained the backbone of the regional economy.

An examination of the environmental setting of the project area in historic times has shown that the first literate visitors to the area found it geographically similar to the way it is today. What did change over time were conceptions about the region. It was the published accounts of the early Spanish and American explorers which shaped the image of the Great Plains in the minds of the rest of the world. To the Spanish this area was a vast expanse filled with buffalo and wandering tribes. They marvelled at the richness of the Arkansas River Valley and hoped to eventually induce the natives to settle there in agricultural communities where they would serve as a buffer on the northern frontiers of New Mexico and become more closely tied to Catholicism and the crown.

The first Americans to journey through the region had a very different impression. They saw the plains as little more than a barren desert

which would certainly halt American settlement at the Mississippi. Later perceptions of the Great Plains included views concerned with its natural advantages as a large open range for livestock or as new land to be put under the plow. Based upon these images, historians from Webb (1931) to Luebke (1979) have treated the Great Plains as a single physiographic unit of study.

3.2 MODERN ENVIRONMENT

In view of the above examination of historic perceptions of the physical surroundings of the project area, the following section provides a general description of the modern regional environment. Four aspects of the modern environment will be discussed: 1) geology, 2) climate, 3) soils, and 4) hydrology. Using the descriptions of both the historic and modern environments as background it is possible to interpolate what the ancient environment of the area was like.

3.2.1 GEOLOGY

The John Martin Reservoir is located in the south-central portion of the High Plains area of the Great Plains Physiographic Province (Hunt 1967). The Great Plains are a vast, gently rolling to flat terrain lying between the forested Mississippi Valley and the foothills of the Colorado Front Range. In the east, increasing rainfall supports a prairie of tall grasses. In contrast, the progressive decline of rainfall as one moves westward towards the Rocky Mountains leads to more xeric, shortgrass prairie: a steppe type of semiarid vegetation. This short-grass prairie, a result of the mountain rain-shadow effect, is to be found on the Plains where they rise against the eastern flanks of the Rocky Mountain uplift at elevations around 1515.2 m (5,000 ft.). This forms the High Plains which is the subject area of our John Martin research.

Customarily, the dry High Plains are subdivided into three subsections--southern, central, and northwestern Plains (Wedel 1978: Figure 5.1). The southern High Plains or Llano Estacado ("Staked Plains") are found in eastern New Mexico and western Texas. The Central Plains, location of the John Martin study area, are made up of the Arkansas and South Platte drainage basins of eastern Colorado and adjacent sections of Kansas and Nebraska. The northern or northwestern Plains extend through Wyoming, Montana, the Dakotas, and into the prairie provinces of Canada. Within eastern Colorado, Wheat (1972: Figure 45) and others make a finer distinction by subdividing the Colorado Central Plains into a northern half and a southern half. In this way the north-central High Plains refers to the South Platte River while the south-central High Plains encompass t'·· Arkansas River Valley.

The study district is underlain by Mesozoic sedimentary rocks, capped by Tertiary sediments mainly from the Rocky Mountains (Hunt 1967). Previous Quaternary studies in the Arkansas River valley have been done by Scott (1964; 1969a; 1969b; Scott et al. 1978). Quaternary nomenclature for the valley has been applied from Scott's original work in the Kassler quadrangle, near Denver (1963). Pleistocene deposits mapped by Scott and applied to the Arkansas Valley (Sharps 1976) include the Nussbaum, Rocky Flats, Verdos, Slocum, Louviers, Broadway, and Piney Creek alluvial units, as well as eolian and loess deposits. However, Holliday's work for this volume (Section 12.0) suggests that these correlations are tentative, and that correlation between major river systems is problematic at best without a better understanding of glaciofluvial and tributary influences on each drainage. For this reason, Holliday uses new, informal names for the terraces within the project area. These are only loosely correlated to Sharps' (1976) terminology. Holliday also correlates eolian deposits south of the river (mapped mainly as the Tivoli soils and associated with Range Sites 19 and 22) as middle and late Holocene deposits.

3.2.2 CLIMATE

The climatological conditions of Bent County are taken from the information provided by the Fort Lyon Canal Company project (Lischka 1979). The climate of the region exhibits low, variable rainfall, abundant sunshine, low humidity, a wide temperature range, and considerable wind. Dry air from the southwest is the common pattern, but in winter, brief periods of northerly air patterns cause sharp drops in temperature. During the spring, summer, and fall, the area is influenced by moist air from the Gulf of Mexico, which brings above normal temperatures, humidity, and most of the region's rainfall. Winters can be fairly mild, with the period December through February being the coldest and driest of the year. However, temperatures will rise above freezing during the day and sometimes reach the sixties and seventies.

Spring is the cloudiest of the seasons, with increased precipitation and high winds during March, April, and May. Summer sees a decline in wind velocities, and short spells of humid air from the Gulf of Mexico increase the thunderhead shower activity. Precipitation remains fairly high through June, July, and August, and temperatures reach 32° C and above about 70% of the time.

According to records of precipitation (1868-1977) for Las Animas, the average amount of rainfall has been 31.0 cm (12.21 in.) (semiarid). This average is taken from November to November of each year to conform with crop years. Over this 109-year span, July is the wet month, averaging 5.4 cm (2.14 in.); and January is the dry month, averaging only 0.7 cm (0.28 in.). Although the rainfall record can reflect plant production, its primary importance for the archeologist is an indication of possible weather patterns that may have influenced past human habitation.

3.2.3 SOILS

Soil surveys have been done all along the Arkansas River in eastern Colorado. A general survey was done by Sweet and Inman (1926) of the valley, from the foothills of the Rocky Mountains to the Kansas border, and will be used to correlate the most recent survey information and terminology in terms of range sites and soil associations (Preator 1971).

Soil in the survey area as defined by Preator include three main soil associations: (1) the Tivoli, (2) Las-Apishapa-Bankard, and (3) the Rocky Ford-Numa.

3.2.3.1 THE TIVOLI ASSOCIATION

Deep soils which are excessively drained, gently rolling to hilly sands on hummocky uplands are called the Tivoli Association. This association includes the Tivoli sand, Tivoli sand (hilly), the Tivoli-Dune land complex, the Travessilla-Olney sandy loams, and the Travessilla-Rock outcrop complex. (See Range Sites 19, 22, 26, 53.)

3.2.3.2 THE LAS-APISHAPA-BANKARD ASSOCIATION

The Las-Apishapa-Bankard Association consists of deep soils which are somewhat poorly drained, nearly level clay loams, and loams on flood plains and low terraces. This association includes the Apishapa clay loam, the Bankard soils, and the Las clay loams (the dark variant, sand substratum variant, and the sand substratum, dark variant). (See Range Site 35.)

3.2.3.3 THE ROCKY FORD-NUMA ASSOCIATION

Deep soils which are well-drained, nearly level to gently sloping clay loams on terraces and uplands comprise the Rocky Ford-Numa

Association. This association includes the Rocky Ford clay loams and the Numa clay loams. (No Range Site Association.)

3.2.4 HYDROLOGY

The two principal, perennial drainages in the John Martin Reservoir area are the Arkansas and the Purgatoire rivers, which join just below the modern town of Las Animas. The Arkansas flows from west to east, and the Purgatoire flows in a northeastern direction. The rest of the area is drained by a number of very small tributary creeks, including the Caddoa, Mud, and Rule creeks.

The section of the Arkansas River flowing through Bent County is underlain mostly by saturated valley-fill alluvium and occupies a trough eroded into the Cretaceous bedrock. The bedrock acts as a barrier to groundwater movement. The permeable alluvial material constitutes the aquifer and is between 0 and 18.2 m (60 ft.) thick, and 1.6 to 8.1 km (1 to 5 m) wide. This aquifer is recharged largely through applied irrigation water and precipitation, and is discharged by seepage into the river, evapotranspiration, and withdrawal from wells. Evidence is available that the groundwater flows generally eastward (Corps of Engineers 1976:247).

This section of the river is described as "gaining" most of the year due to the returning irrigation waters through groundflow (Corps of Engineers 1976:247). This effect is greater below Las Animas, where the valley-fill aquifer narrows from 8.1 km (5 m) to only 1.6 km (1 m), and forces groundwater into the stream. This effect is illustrated by measurements taken on October 31, 1967 and March 29, 1969. Though no average flow is given for the river, measurements of flow from the Bent-Otero county line to Las Animas showed a gain of 0.48 ds/sec. (1.7 cfs, cubic feet per second) in 1967, and 4.25 ds/sec. (15 cfs) in 1969. Measurements between the Las Animas gauge and the Fort Lyon hospital gauge showed gains of 13.3 ds/sec. (47 cfs) in 1967, and 4.8 ds/sec. (17 cfs) in 1969 (Corps of Engineers 1976:248). No mention is made of precipitation or run-off around these dates, but the point to be made is that below Las Animas, potential flow is, and probably has always been, greater than the area upstream from Las Animas, due to the progressive narrowing of the valley-fill aquifer below Las Animas and to the additional waters from the Purgatoire River. This may directly affect patterns of habitation on the terraces above the river in this area.

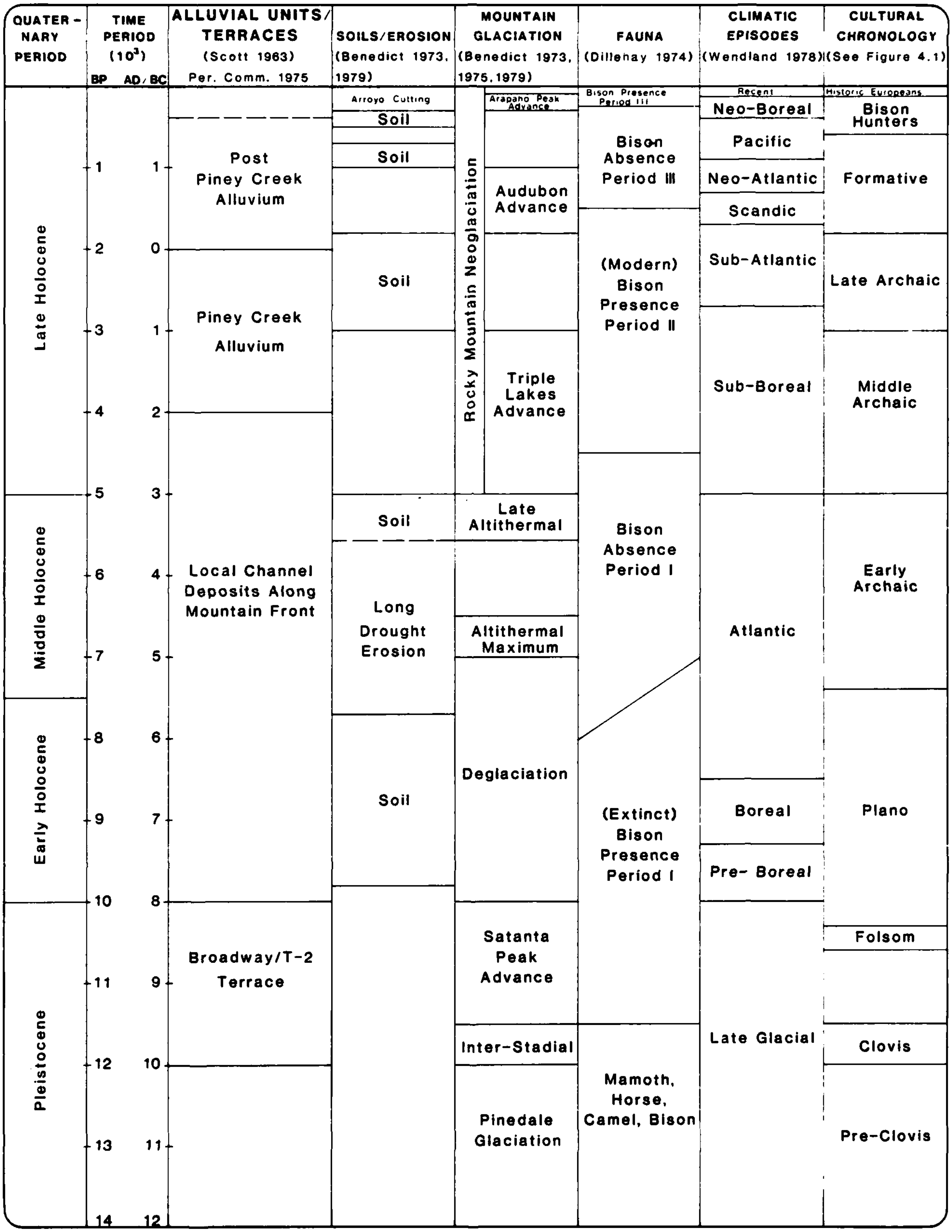
3.3 ANCIENT ENVIRONMENTS

In the discussion to follow, we will briefly outline what is known about the changing environments of the late Quaternary Period of southeastern Colorado. This regional approach will deal with environmental investigations which have been conducted from the Continental Divide of the Colorado Front Range on the west to the foothills and Central Plains on the east. The purpose will be to provide an environmental backdrop against which changing patterns of prehistoric adaptation can be assessed.

3.3.1 QUATERNARY PERIOD

The Quaternary is a period of the geological calendar covering the last several millions of years of the earth's natural history. Geologists subdivide the Quaternary, or fourth period, into two Epochs: 1) the Pleistocene and 2) Holocene (Fig. 3.1). The Pleistocene Epoch is marked by the waxing and wanning of ice sheets of which the last is called the Wisconsin glaciation in North America. This was a cool, rainy climatic episode of expanding continental ice caps of which the Laurentide of the Hudson Bay area and the Cordillern sheet of the Pacific Northwest were most prominent. However, corresponding small-scale mountain glaciation was taking place at high elevations in the Rocky Mountains of Colorado of

FIGURE 3.1
ENVIRONMENTAL CHRONOLOGY



which the Pinedale glaciation and Satanta Peak advance are the local Wisconsin equivalents (Fig. 3.1).

The Holocene Epoch, sometimes called the Recent, is the period of geological time when the major ice sheets and mountain glaciers had largely disappeared. This post-glacial interval is taken to be the last 10,000 years by geological convention. In eastern Colorado, generally accepted evidence of human occupation spans the last 12,000 years from Clovis culture to the present; an interval of history dateable in geological terms from the late glaciation entirely through the Holocene.

In order to more precisely periodize the Holocene, we have subdivided in into early, middle, and late according to the trends of postglacial temperature. Following the last major retreat of the Satanta Peak stade around 10,000 years ago, world temperatures rose to a peak maximum about 6000 B.P. after which the climate cooled somewhat after 5000 B.P. According to this climatic reconstruction, early Holocene is the interval of deglaciation as the continental sheets melted back and mountain glaciation in Colorado shrunk. Between 4000 and 7500 B.P, that period of time which Ernst Antevs (1955) called the Altithermal or high temperature, the mountain glaciers are all gone. Evidence is also present that this Long Drought was not only hot but also dry, sufficient to reduce the forage potential of the short-grass prairie, thereby affecting the carrying capacity of bison herds. Both bison and human bison hunters of the early Archaic were forced to evacuate to higher altitude refugia where the climate was cool and moist (Benedict 1979). The giant Pleistocene bison species (*Bison occidentalis*) became extinct to be replaced by modern bison (*B. bison*).

Around 5000 B.P., world temperatures returned to more moderate values like those of today inaugurating the late Holocene, a time when local glaciation returned to the Rocky Mountains of Colorado. It has been estimated by Antevs (1955) that temperature values were intermediate between the cool, moist glacial period and the warm, dry (wet some places) Altithermal. The late Holocene has variously been called the Medithermal Period by Antevs and Neoglacial Period by others. The return to more moderate climatic conditions allowed the bison herds and humans to reoccupy the Central High Plains during the Archaic, Formative, and bison hunter stages of prehistory. However, at least one researcher (Dillehay 1974) has argued that the bison herds of the southern Plains continued to show cyclical oscillations in range and density under the influence of fluctuating and marginal rainfall. During the late Holocene, streams expressed episodic patterns in their discharge changing between aggradation (filling) and degradation (arroyo cutting); shifts recognized by Scott (1963, 1975, per. comm.) as the Piney Creek alluvial chronology. Other lines of geological evidence for postglacial environmental reconstruction are episodes of soil formation (Benedict 1973, 1979), eolian deposition of dune fields (Muhs and Madole 1980) and blowout wind scoured depressions.

3.3.2 PINEY CREEK ALLUVIAL CHRONOLOGY

The alluvial and terrace sequence for southeastern Colorado and contiguous localities has been comprehensively reviewed by Holliday in this volume (Section 12.0). The discussion to follow will emphasize the relation of archeological remains to two alluvial floodplain sequences in eastern Colorado: the LoDaisKą and Magic Mountain sites (Irwin and Irwin 1959, Irwin-Williams and Irwin 1966). The purpose will be to reveal the stratigraphic relationship between the Piney Creek alluvium and archeology as well as the chronological control that archeology can provide to the dating of cut/fill sequences.

Both archeological sites are floodplain sequences containing massive cultural midden deposits which were laid down as stream alluvium was aggrading to form a mixed deposit of cultural and natural sediments. In both cases, the archeological record is continuous from early Archaic through the Woodland Period. Magic Mountain in particular is one of the most completely documented long stratigraphic sequences in eastern Colorado and one which is most often used for comparison by surrounding research endeavors. In both sites, the basal sedimentary deposits are channel gravels. At Magic Mountain, the channel deposits contain early Archaic side-notched projectile points which the Irwin's called MM-3's (Magic Mountain type Number 3) or Mount Albion complex. These have been radiocarbon dated by Benedict (1979) to the late Altithermal between 6000 and 5500 B.P. Scott (1975, per. comm; Windmiller and Eddy 1975) would date this geological unit (Nos. 6 and 7 or Unit F of the archeologist) to the pre-Piney Creek alluvium. However, this unit is not recognized by Machette (1975) and others along main streams of eastern Colorado; both Magic Mountain and LoDaisKa are situated on small tributary drainages immediately on the Plains/foothills boundary. At the LoDaisKa site, the same channel deposit is present but it contained a Plano point of Paleo-Indian age rather than the early Archaic.

The overlying alluvial units at both sides are floodplain rather than channel sediments containing middle and late Archaic archeology of the McKean techno-complex and Apex assemblages. The floodplain sediments in question are called the Piney Creek alluvium (Scott 1975, per comm) which is dated by the projectile-point styles between 2000 and 4000 B.P. by comparison to the Wyoming horizonstyle chronology of Frison, Wilson, and Wilson (1974, Windmiller and Eddy 1975).

The third and final alluvial unit recognized in eastern Colorado is called post-Piney Creek, dated to the historic period but sometime prior to the recent epicycle of arroyo cutting, which began around A.D. 1880 to 1900. The unit extends back to about the time of Christ. At Magic Mountain, it contains Woodland archeology while elsewhere it likely was being deposited during Panhandle, Proto-Historic, and early Historic times.

In general, then, the Piney Creek alluvial units correlate rather well with the resurgence of Neoglaciation in the Rocky Mountians. The implication is that floodplain deposition was taking place after 4000 B.P. under the influence of moderate stream discharge following the erosional and soil-forming episode of the middle Holocene Altithermal Long Drought.

3.3.3 SAND DUNE FIELDS

Muhs and Madole (1980) have recorded widespread evidence for movement of dune sand on the Central High Plains during the Altithermal. Presently stabilized dune fields in the Nebraska Sand Hills, western Kansas and eastern Colorado were mapped and modern and buried soils studied. Radiocarbon ages from stabilized dunes in Nebraska are of Altithermal age dating between ca 8000 and 5000 years B.P. Furthermore, the similarities of soil development on and in the dunes supports the conclusion of a single period of dune-field activity with stabilization through vegetation anchoring after 5,000 radiocarbon years ago. Their interpretation of published soil surveys along the Cimarron and Arkansas Rivers in western Kansas displays a similar degree of soil development on stabilized dune fields providing additional support for the idea of regional aridity during Middle Holocene times.

The regional research of Muhs and Madole (1980), although not conducted directly in the John Martin Reservoir area, lends very strong support to our hypothesis that local stabilized

dune fields labeled as Range Sites 19 and 22, are also part of this regional evidence for Altithermal aridity. Holliday (1980, pers comm) has suggested that northwesterly winds scoured the Arkansas River floodplain, picking up sand which was then deposited as the sand dune field along the southern margins of the inner river valley. Such aeolin deposition would have taken place as the wind velocity was checked following air movement out of the inner Arkansas valley. In this hypothesis, stabilization of these dunes by vegetation, principally grass cover, took place during the Neoglacial Period. Support for this age is provided by the few dateable surface Archaic sites which have produced large corner-notched dart points with an age span of 3000 B.P. and later. The few buried archeological sites exposed by wind deflation (blow-outs) are not presently dateable, but by this Altithermal hypothesis, they should be early Archaic or older in age.

3.3.4 MOUNTAIN GLACIATION

Studies in the Indian Peaks District west of Boulder, Colorado, have revealed high altitude evidences of climatic change from late Pleistocene through Holocene times (Benedict 1975). Principal among the lines of evidence are moraines, protalus ramparts, and rock glaciers, but support for a glacial chronology is also supplied by downslope movement of soil, palynology, and patterned ground. Conclusions drawn from these data indicate that several stages of mountain glaciation took place at the end of the Pleistocene after which glaciers completely disappeared during the ensuing middle Holocene Altithermal Long Drought. The late Holocene was marked by a resurgence of more moderate size mountain glaciers, Triple Lakes, Audubon, and Arapahoe Peak, in three named episodes to form the Neoglaciation. Interglacial episodes along the continental divide are marked by soil formation (Fig. 3.1).

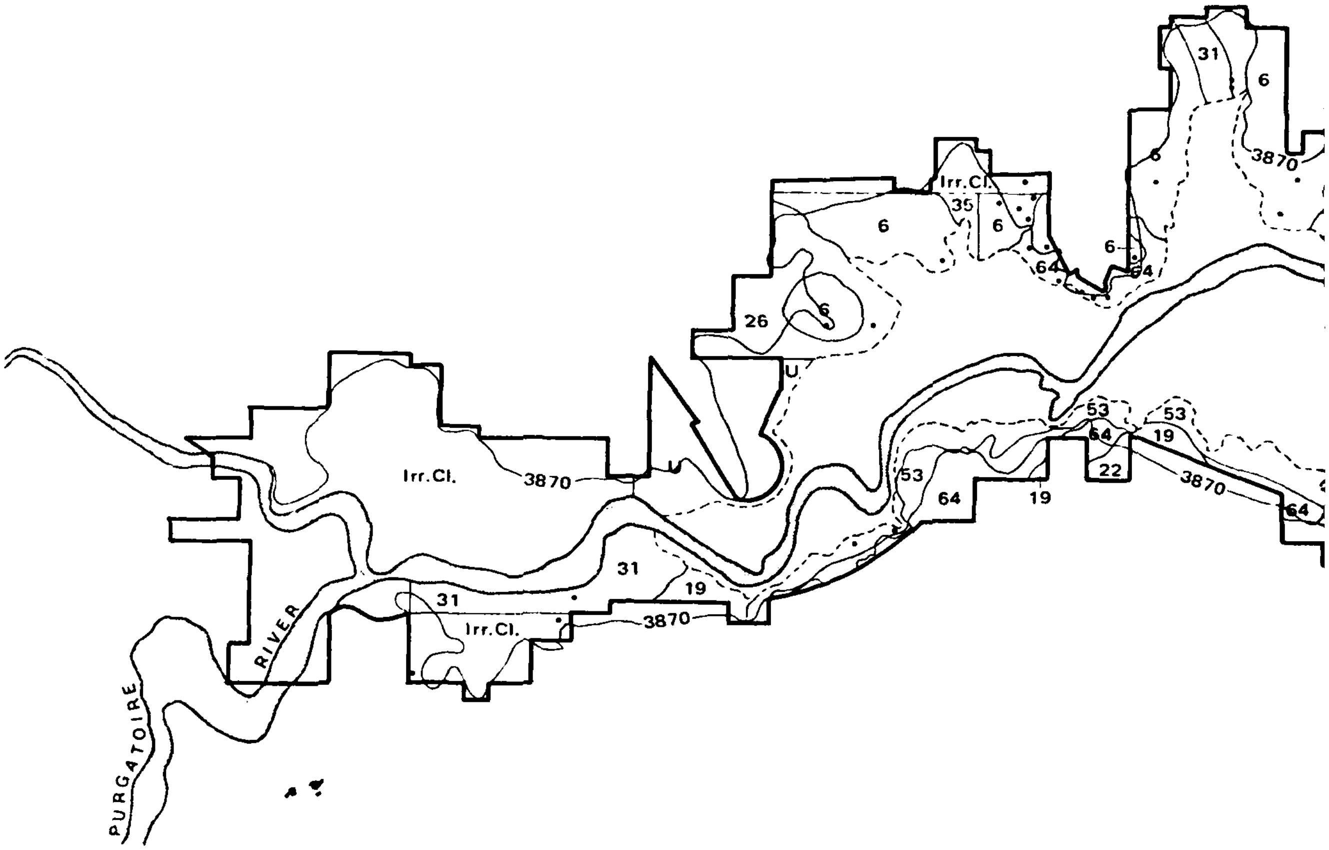
The disappearance of glaciers between 5000 and 7500 B.P. forms some of the most convincing evidence for the Altithermal period in eastern Colorado. Benedict (1979) postulates that this middle Holocene episode of drought was most intense during two periods: the Altithermal maximum dated between 7000 and 6500 B.P. and the late Altithermal bracketed between 6000 and 5500 B.P.

The postglacial warming trend noted in the end-moraine chronology is also registered in a pollen diagram taken from the muddy floor of Red Rocks Lake (Maher 1972). Here the gradual upslope advance of the boreal forest treeline is documented as a reflection of the Altithermal temperature peak. However, the Neoglacial cooling is not registered in the pollen data.

3.3.5 BISON CHRONOLOGY

Given the warming and cooling trends evident in the temperature and sedimentary record, it is not surprising that variations in past vegetation and faunal records have also taken place. Especially changes in prairie forage would affect the large herds of herbivorous bison which formed such an important part of the hunting subsistence for ancient Plains peoples. For these reasons, a bison chronology, constructed by Dillehay (1974), is useful in assessing the hunting potential of the John Martin prehistoric sites. Dillehay's sequence consists of bison presence and absence for the Southern (Llano Estacado) Plains of Texas and Oklahoma (Figure 3.2). This sequencing, which is based on 160 archeological and paleontological sites, shows two absence periods of which the older correlates with the middle Holocene (6000/5000-2500 B.C.) while the latter is late Holocene (A.D. 500-1200 or 1300) in age. Three intervening numbered episodes of bison presence are recorded for the: (1) late Pleistocene-early Holocene, (2) the beginning of the late Holocene, and (3) the proto-historic periods. Presence Period I of late Pleistocene times is an interval of extinct bison forms of which the *Bison antiguus* and *occidentalis* species are documented

FIGU
SCS RANGE SITE COVERAGE AND
JOHN MARTIN RE

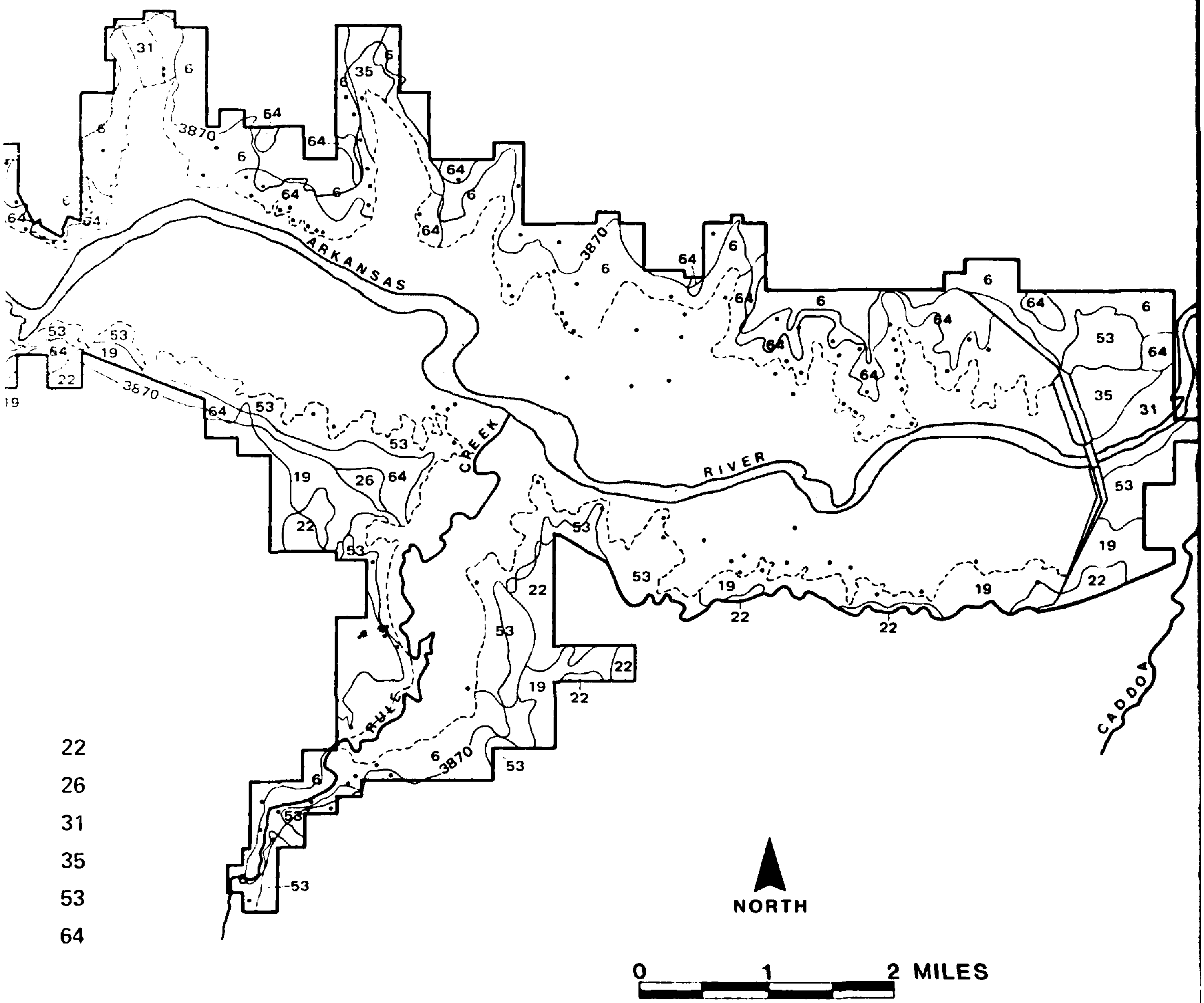


Study Area Boundary	———	Choppy Sands	22
Top of Flood Control Pool	3870	Sandy Plains	26
Archeological Site	•	Sandy Bottomland	31
3850' Contour Interval	- - -	Salt Meadow	35
Irrigated Cropland	Irr. Cl.	Sandstone Breaks	53
Urban Area	U.	Gravel Breaks	64
Loamy Plains	6		
Deep Sand	19		

FIGURE 3.2

;OVERAGE AND ARCHEOLOGICAL SITE LOCATIONS

OHN MARTIN RESERVOIR PROJECT



22

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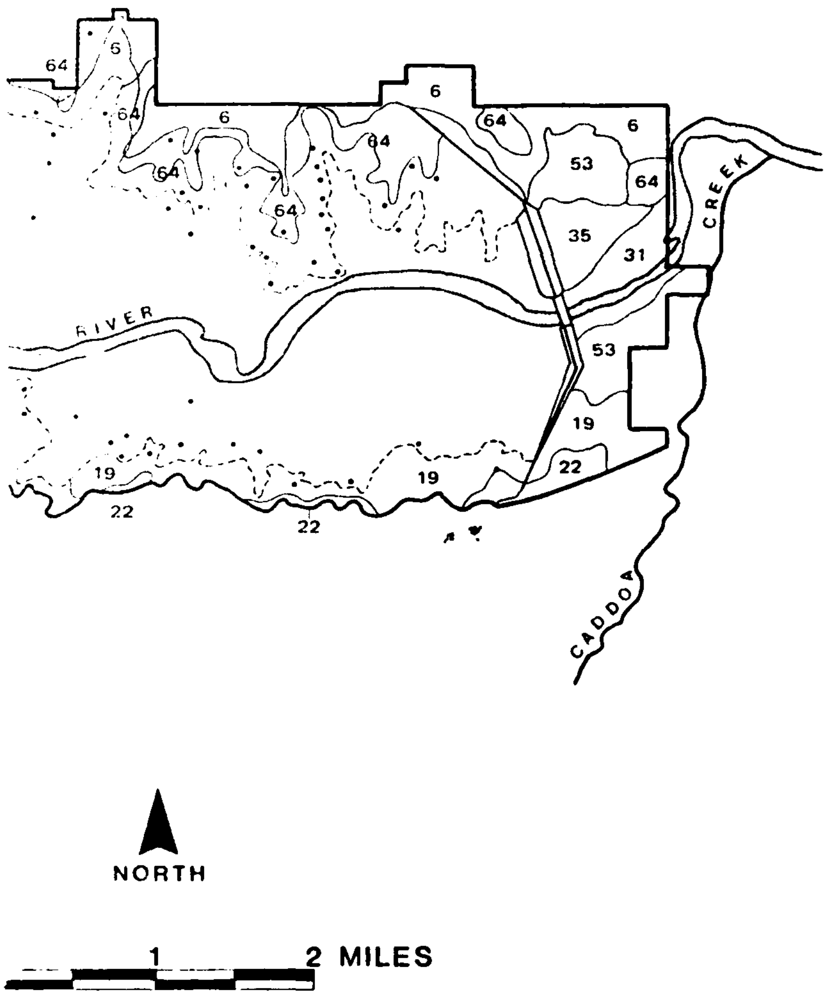
:ATIONS



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NORTH
1
2 MILES

for Folsom and Plano times. The giant Pleistocene bison become extinct during the Altithermal bison absence period when they are replaced by modern bison (*B. bison*) which survived off the Great Plains in refuge areas such as the Front Range Rockies and/or on the Northern Plains. Bison Presence Period II, marked by large herds of modern bison, were hunted by middle and late Archaic peoples using game drive techniques including arroyo and sand dune traps; resurgence of hunting technology from Plano and Folsom times (Frison 1978; Wheat 1972). Bison Absence Period II, dated between A.D. 500-1200 or 1300, correlates with the rise of village horticulture on the High Plains. This Formative Stage pattern can be traced from south Texas far north into the northwestern Plains. This village life abruptly collapsed in the thirteenth century, perhaps due to the Great Drought of Antevs (1955) which is tree-ring dated in the American Southwest between A.D. 1276-1299. The succeeding Bison Presence Period III saw the return of bison hunting as a major subsistence pattern on the High Plains using drive lines and cliff jumps as the principal hunting technology. In southeastern Colorado, these people are known through ethno-historic accounts of Spanish explorers and early trader-trappers. During the Proto-historic Period (A.D. 1550-1750), the semi-nomadic dog travois Apache were engaged in bison hunting and were followed by horse-mounted historic Plains Indians, such as Comanche, Kiowa, Cheyenne, and Arapahoe, who were highly mobile historic bison hunters.

3.3.6 PAST CLIMATIC HISTORY

Wendland (1978) has reconstructed the ecological setting and climatic background of man in North America east of the Rocky Mountains. His study utilizes the climatic chronology of named periods as framework for tracing the movements of major vegetation zones from the end of the Pleistocene through the Holocene Epoch. In our review of Wendland (1978), we will focus on the vegetation-climatic events which are most pertinent to the Great Plains.

3.3.6.1 LATE GLACIAL (UNTIL CA 10,030 B.P.)

During the cool, moist Late Glacial (Pinedale and Satanta Peak stades), the vegetation zones of North America were displaced well to the south of their present location. Wendorf (1961) has documented the presence of coniferous parklands on the Southern High Plains during Clovis and Folsom times. It has been estimated that the Great Plains mean temperature was a few degrees Celsius cooler than today.

3.3.6.2 PRE-BOREAL (CA 10,030-9300 B.P.)

After 10,000 B.P. deglaciation was apparent in both the continental and mountain glacial snow masses. This continental warming is also reflected in the change from boreal parkland to short grasses on the High Plains during the early Holocene. At the same time, vegetation boundaries in the East were shifting northward congruent with the track of storm fronts, cloud masses, and precipitation. Further, the tall-grass prairie ecotone was moving eastward at the expense of woodlands and forests.

3.3.6.3 BOREAL (CA 9300 8490 B.P.)

Deglaciation continued with the shrinking of the Laurentide ice sheet which retreated north of the Great Lakes. The tall-grass prairie of the Great Plains moved further east and north.

3.3.6.4 ATLANTIC (CA 8490-5060 B.P.)

The northern boundary of the conifer-hardwood forest reached its present position by

8000 B.P. as the Laurentide ice shrank to a mass located at the Hudson Bay. The Atlantic Period is thought to have been an interval of thermal maximum 2° C to 3° C higher than today's temperatures based on palynological investigations conducted in Europe. Wendland (1978) believes that the Great Plains were warmer and drier than today and especially during the interval 7000 to 5500 B.P.; this dating is very comparable to that given for the equivalent Altithermal of Antevs (1955).

> Webb and Bryson have also determined that continental Arctic air (Canadian) was less frequent in the northern Plains than now with greater frequencies of Pacific air, supporting the hypothesis of stronger westerlies. The increased frequency of Pacific air results in substantial warming through drying due to the rainshadow effect of the Rocky Mountains (Wendland 1978: 279).

In general, the prairie expanded much further north than before or since providing an increased area for bison range. It seems likely that bison herds had shifted into these northern latitudes as a refuge, vacating the Southern Plains to form Bison Absence Period I.

3.3.6.5 SUB-BOREAL (CA 5060-2760 B.P.)

The Western Plains were becoming wetter than present while the Laurentide ice sheet was essentially wasted.

3.3.6.6 SUB-ATLANTIC TO PRESENT (CA 2760 B.P. TO PRESENT)

After 4000 B.P., the major vegetation zones and general pattern of atmospheric circulation had stabilized at about their present locations. However, tree lines shifted southward significantly after 3500 B.P. only to readvance northward by 1000 B.P..

> The sub-Atlantic was characterized by a deterioration in climate, particularly north of 40 degrees N. latitude, with cyclones restricted to a more southerly course. A warming trend ensued during Scandic time, culminating during neo-Atlantic (Wendland 1978:281).

The Neo-Atlantic (1260-860 B.P.) was a time of more moisture on the Plains supporting the Plains Formative village horticulture. This food-producing pattern began to collapse with the switch to dessication which is characteristic of Pacific times at ca 850 B.P. The Little Ice Age or Neo-Boreal period (ca 400-100 B.P.) was generally colder (ca 1° C) than today. It is marked in Europe and the Arctic North America by a short-term resurgence of glacial activity; an environmental event in the Colorado Front Range called the Arapahoe Peak advance (Figure 3.1).

In conclusion, the climatic chronology of the Plains and Eastern Woodland supports the regional southeastern Colorado environmental reconstruction. Further, it provides a quite fine-grained periodization by which environmental changes can be related to changing patterns of cultural adaptation useful in the study of human lifeways and cultural evolution.

3.4 RESEARCH GOALS AND ENVIRONMENTAL VARIABLES

The dual research goals to be pursued in this study are investigations into functional lifeway reconstructions and the evolutionary growth and development of past societies. It is a given that the functional behavior of societies and their evolution through time is a result of successful adaptations to their environmental settings. Anthropologists generally recognize two kinds of

adaptations: (1) that which relates a society to its natural or physical habitat and (2) that which relates the society to its neighboring peoples. In this discussion, we plan to lay a background for the study of past environments (paleo environments) as these have provided both challenges and limitations for successful adaptations of Type 1 (Steward 1955).

Adaptation to the natural environment will be defined as the interrelations developed between a culture and the environment for the extraction of materials and energy necessary for the continued operation of that society. Such extraction is carried out through techno-economic knowledge and equipment as well as through institutionalized forms of human organizations, such as the work group.

The following modern environmental variables (VAR No.) will be used as predictors in modeling the archeological site distribution in *Section* 6.2. Variables 9-20 are all some form of interval measurement which can be employed in the Regression analysis for site prediction. In addition, Variables 8 and 21-28 are nominal or ordinal measurements which will be used in association or nonparametric correlation with site variables. All of the environmental variables have been derived from the Colorado Site form and SCS Range Site classification.

3.4.1 SCS RANGE SITES

The soils of the survey area have been grouped into range sites. Range sites are rangeland that differ in the amount and types of vegetation they can produce (Preator 1971:41). A range site might be seen, for present purposes, as a fairly specific environmental niche within a more inclusive ecosystem. In the reservoir area, the amount of available moisture is an important factor in determining the vegetation of each range site and its productivity. Most range site studies have been directed toward contemporary agricultural adapations, but this knowledge can also be useful in prehistoric and historic studies because one can infer from it what kinds of native plants and animals could have been supported in pre-European times (Fig. 3.2).

Having knowledge about the most widespread crops native to a range site may enable specific correlations to be made between the vegetation and land-use patterns by aboriginal inhabitants. In addition, some animals exploited by aboriginal peoples also depended on vegetation. Therefore, the native vegetation of a given range site indicates what flora might have been used by humans (edible and useful species), flora that was crucial for game animals, and the distribution pattern of game over the study area.

The soil survey for Bent County defines 14 range sites. However, the area under study is covered by only a few of these. The present area around the reservoir is dominated by Range Sites 6, 19, 22, 31, 35, 53 and 64 (Preator 1971).

3.4.2 DISCUSSION OF SOILS

For purposes of this survey, one must keep in mind that inundation of the area by the reservoir plays some part in the presence and identification of these range sites and their associates soils; however, it does not appear to have significantly affected the main soil types and range sites of the survey area, so that a reasonably certain correlation can be made between the soil types given by Sweet and Inman (1926) and the soil types and range sites of Preator (1971).

Specifically, there is more of an association with sandy range sites and sandy soils immediately south of the reservoir, as mapped in 1971, than to the north. Such is also basically the case in Sweet and Inman's work, though they failed to map the area immediately south of the reservoir dealt with in this survey. The sand deposits

appear due to the prevailing wind in the area blowing from across the river floodplain, depositing windblown material as sandy parent material for later soils, and as dunefields, shown by Preator as the Deep Sand and Choppy Sands Range Sites (Nos. 19 and 22).

According to Sweet and Inman, the majority of the soils present in 1926 that now are flooded by the reservoir belong to Range Site 6 and Range Site 35, with only a few belonging to 19, 22, 31, or 64. Range Site 6 is found mainly to the north, upland from the reservoir, while Sites 19 and 22 are found to the south in the uplands. Range Sites 31 and 35 can be considered modern river wash, due to their location in the modern floodplains adjacent to the river channel.

3.4.3 RANGE SITE TYPE (VAR8)

The SCS Range Sites are described below in terms of soil type, major and minor vegetation, relative preference of wildlife, and standing crop productivity. Seven range sites are found in and around the reservoir and these were coded as nominal (discrete) observations using the SCS code of Preator (1971). They were paired with site counts to run Chi-square association tests in order to identify over-represented and under-represented range types (Fig. 3.2).

3.4.3.1 LOAMY PLAINS (6)

Soils included in this range site are the Baca loam and silt loam; Colby sandy loam and silt loam; the Fort Collins loam; the Harvey loam; the Kim loam; the Manvel loam and silt loam; the Minnequa, Renohill, Stoneham, and Tyrone loams; and the Wiley silt loam. These soils consist of medium-textured to fine-textured, generally deep soils. The potential plant community on this site is approximately 65% blue grama and 10% galleta. There are only small amounts of three-awn, sand dropseed, wild alfalfa, prickly pear, snakeweed, ring muhly, and rabbitbrush. In areas where moisture is adequate, buffalo grass makes up a small percentage of the plant community. Alkali sacaton occurs in a few places.

Optimum plant density is 35%. This ground cover provides ample amounts of litter and forage residue to protect the soils from blowing and water erosion. A downward trend in range condition is indicated by an increase in the proportion of buffalo grass, galleta, or sodbound blue grama. Further deterioration is indicated by a decreased density of cover and an increase in the proportion of annuals. Precipitation records indicate there have been several periods of extended, below-average rainfall since 1868 (Lischka 1979). This, coupled with heavy livestock grazing practices, has contributed to range site deterioration. Total annual production for this range site is given as 1500 air dry pounds per acre during favorable years, only 200 pounds during unfavorable years, and 800 pounds as the median.

Present conditions in this range site best support antelope and jack-rabbit, with the area rated only medium for support of bison, and low for cottontail (USDA-SCS 1976). This range site is mapped mainly to the north, and upland from the reservoir. It roughly correlates to Holliday's Hasty surface (Section 12.0).

3.4.3.2 DEEP SAND (19)

Upland soils in this site are the Dwyer and Tivoli sand, and the Valent loamy sands. These soils exhibit single grain to very weak structure, with moisture penetration very rapid and deep. Water-holding capacity is low, but moisture is given very readily to plant roots. This condition favors the tall grasses with deep roots, but remains susceptible to wind erosion. Water erosion is present, especially where stock trails or other disturbances provide for rapid runoff.

The potential plant community on this site is approximately 25% sand bluestem, 20% blue grama, 15% sand reedgrass and needle-and-thread, with optimum ground cover about 40%. As disturbance takes place these will be replaced by sand dropseed, blue grama, sandsage brush, yucca, blowout grass, and lemon scurfpea. Total annual plant production should range from 2000 pounds per acre air dry during favorable years to 800 during unfavorable years, with 1200 pounds the median yield.

Present conditons on this site appear to best support antelope, bison, cottontail, and jackrabbit, with deer and upland game birds given medium support. This range site is mapped to the south, upland from the reservoir. It corresponds to Holliday's middle or late Holocene dunes, and the modern floodplain (Los Animas terrace).

3.4.3.3 CHOPPY SANDS (22)

Upland dunefield soils included in this range site are the Dune land, Tivoli, and Tivoli sand. These are characterized as loose, unstable sands, low in organic matter, but capable of becoming vegetated. There is no development of the soil. These features aid in distinguishing this site from deep sand. The landscape is choppy, with dune-like topography and with slopes varying from 0-47%. Plants found at this site are deep-rooted grasses, adapted to grow on deep, loose sands. Potential vegetation includes sand bluestream at about 25%, sand reedgrass at about 20%, and needle-and-thread at about 15%. The lemon scurfpea is a good plant indicator of this site and establishes itself on blowouts. No trees are native to this site, and the optimum ground cover is about 30%. This range site is mapped to the south and upland from the reservoir. It corresponds to middle or late Holocene dunes (Section 12.0).

Total annual plant production is rated at 1,400 pounds per acre air dry, with unfavorable years rated at 600 pounds, 1,200 pounds being rated as median.

Present conditions on this range site are rated as only medium for support of antelope, bison, jackrabbit and upland game birds, with support for deer and cottontail rated low.

3.4.3.4 SANDY BOTTOMLAND (31)

Floodplain soils included in this site are the Bankard sandy loam and the Bankard loamy sand. These soils are usually deep but may be shallow and underlain by clean sand or gravel. The sandy texture, with its faster intake and deeper penetration and more ready release of moisture than heavier soils, is the principal factor affecting plant growth. Therefore, the vegetation is a mixture of tall and midgrasses with the tall grasses typical of slightly more moist locations. Salt concentration is not strong enough to seriously affect climax vegetation, but it may cause such species as saltgrass to become abundant when the range is misused. A lower moisture content in the upper foot or two of soil often makes the effect of salts more pronounced than on adjacent wet meadows.

Potential vegetation has a definite tall-grass appearance, dominated by about 25% switchgrass, followed by around 15% of both sand bluestem and prairie sandreed. Ground cover is uniform with no bare spots, with the optimum cover being about 40%. Litter is abundant, with several inches of the topsoil darkened by organic matter. Occasional cottonwood trees and tamarsak bushes boardered the Arkansas River channel prior to dam construction (US Engineers topographic map 1940). More dense stands of tree growth once existed just below the damsite.

Total annual production may reach 2500 pounds per acre air dry during favorable years,

only 1200 during unfavorable years, and 1800 pounds as the median figure. The site is therefore rated as medium support for all fauna discussed previously, neither high nor low for any. This range site is mapped mainly downstream from the reservoir, within the floodplain, near the river. It corresponds to the modern floodplain (Las Animas terrace).

3.4.3.5 SALT MEADOW (35)

Floodplain soils included in this site are: Apishapa clay, Apishapa clay loam, Apishapa loamy sand, the Bloom loam, the Harvey loam, the Haverson loam, Hayford silty clay loam, Heldt clay, Heldt clay loam, Las loam, Las clay loam, Las Animas soils, Lebsack clay loam and silty clay loam, Loveland clay loam, Mosher clay and loam, Wann soils, and the Westplain silty clay loam. These soils are variable in texture and saline. They are generally alluvial and characterized by a high water table as seen by gleying or mottling.

Potential vegetation of this site includes the alkali sacaton at about 45%, switchgrass at about 20%, and western wheatgrass and saltgrass at between 15 and 20%. These give the site a meadow appearance, with cottonwoods and willows of river bottoms often forming bordering plant communities. Ground cover can be as much as 50% or more. With destruction of cover, plants most likely to invade are the tamarix, gumweed, kochia, Russian thistle, poverty weed and prickly pear.

Total annual production may reach 3000 pounds per acre air dry during favorable years, only 1000 pounds during unfavorable years, and a median of about 2500 pounds. No wildlife value rating was given for this site (Preator 1971). This range site is mapped downstream from the reservoir, within the modern floodplain, near the river. It corresponds to low areas between the Hasty gravels and bedrock (Section 12.0).

3.4.3.6 SANDSTONE BREAKS (53)

Soils included in this range site are the Travessilla sandy loam, loam, and stony loam. These soils are stony or rocky sandy loams or loams. Moisture intake is good and the presence of stones enhances soil moisture relationships for plants. Sandstone outcrops are frequent.

The landscape varies from very steep breaks, escarpments, or side canyons to gently sloping areas above canyon rims and breaks on the shallow-to-sandstone soils. This range site corresponds to Dakota Sandstone bedrock (Section 12.0).

Plants found on this site include widely-spaced pinyon and juniper, plus a wide variety of grasses, such as side-oats grama and blue grama that potentially occur at about 30% each by weight. With range deterioration, juniper can completely occupy the site, with little vegetation under the canopy.

Total annual plant production is rated at 2400 pounds per acre air dry in favorable years, and 400 pounds in unfavorable years. 800 pounds is the average.

Present conditions are rated high to support deer and cottontail and medium for fowl and domestic grazers.

3.4.3.7 GRAVEL BREAKS (64)

Cascajo sandy and sandy loam are the soils of Range Site 64. These are shallow, coarse-grain soils in which the moisture intake is rapid although the holding capacity is low.

The most common native potential vegetation for the Gravel Breaks is side-oaks grama making up 30% composition by weight. Other elements of the standing crop are Blue grama 25%), Indian ricegrass (10%), Needle and threadgrass (10%),

and other less common grass species. "Small soapweed, cholla, low rabbit brush, and skunk-bush sumac, are common shrubs while buckwheat, Nuttals evolvulus and prairie clover are frequent perennial forbs." (USDA SCS 1976). "One seeded Juniper and Pinyon pine may occur on this site but do not form any dense stand." (USDA SCS 1976). The optimum ground cover is about 30%.

During favorable years, the Gravel Breaks range site may produce as much as 1600 air dry pounds of forage per acre. This value drops to 400 pounds during unfavorable years while the median productivity figure is 800 pounds per acre.

Cottontail, jackrabbit, and upland game birds favor this habitat (High value ratings) while antelope are rated at a medium value. The only other big game making an appearance is deer rated at a low value.

This range site is principally found as a high bench along main drainages of the Plains such as the Arkansas River. Its mapped distribution lies mainly in discontinuous patches found along the north side (left bank) of the John Martin Reservoir where it appears on moderately steep slopes of 9 to 25% slope. This range site probably corresponds to the Caddoa gravels, though they are not mapped on the south side of the reservoir (Section 12.0).

3.4.3.8 INDETERMINATE (100)

Archeological sites coded as 100 on variable Number 8 were those for which no particular range site could be determined. Uncertainty was usually introduced into the recording when archeological site locations spanned the boundary of two contiguous range sites. This range site may correspond to any number of alluvia or eolian units.

3.4.4 ONSITE SLOPE (VAR9)

According to the manual of instructions for the Colorado Cultural Resource Inventory Forms (n.d.), percent grade is a measure of the steepness of slope. "Percent grade is defined as a ratio of the change of elevation in a given distance expressed as a percentage." In the John Martin Reservoir study, it was measured by placing a Brunton compass on the ground and adjusting the vertical level with readings taken off the percent grade scale. Where several readings were necessary, the median figure was employed in the computer study.

Slope is potentially important in site selection with more level grades being attractive to campers while steeper slopes would be disfavored since they require effort to maintain an upright standing position.

3.4.5 SURROUNDING SLOPE (VAR10)

A continuous, or interval, level measurement of slope was taken of the offsite terrain in the same fashion as Variable 9. It is expectable that campers would select level sites, but these may be chosen at locations near steep slopes as at the breaks on the front edge of Pleistocene terrace affording a good view of the Arkansas Valley where game would approach for watering. Other possibilities are offsite steep slope choices for shelter from wind and weather.

3.4.6 ASPECT (VAR11)

According to the Colorado Cultural Resource Inventory Form manual, "aspect is defined as the direction which a slope faces; it is the downhill orientation expressed as a compass heading. Aspect is calculated from USGS topographic quadrangle by taking a reading perpendicular to the contours of the site area." (OSAC n.d.).

Several hypotheses are current in the litera-

ture as to the manner in which aspect influences choice of site selection (Grady 1980: 166-170). One is that north-facing slopes (0-90° and 270° to 360° will be selected as camp sites during the summer season to diminish the heating effect of solar radiation. In contrast, camps pitched during the winter will favor south-facing sites (90° to 270° heading) in order to capitalize on solar warming.

3.4.7 SITE ELEVATION (VAR12)

The mean elevation of a site is taken from the USGS contour lines. The map-derived figure in feet above mean sea level (msl) is converted to meters by multiplying by 0.3048.

In absolute terms, elevational relief on the High Plains is not great. However, sites situated at low elevation will express a preference for proximity to the Arkansas floodplain while higher elevation sites will indicate a favoring of upland praire.

3.4.8 DISTANCE TO NEAREST INTERMITTENT DRAINAGE (VAR 13)

Straight-line distance from the site to the nearest intermittent (dry) water course is measured in meters. This figure can be scaled from the USGS quadrangle for upland sites but must be taken from the COE topographic map of 1940 for those sites lying below the present full pool reservoir limits.

Distance to water may be an important determinant for site selection due to the need for drinking water. Today's intermittent drainage may have been a flowing brook during mesic climates of the prehistoric past, particularly during the late Pleistocene and early Holocene times.

3.4.9 HEIGHT ABOVE INTERMITTENT DRAINAGE (VAR14)

Calculated from a map as the site elevation (VAR12) minus the elevation of the intermittent drainage read from the nearest straight-line point to the site. The difference between these two figures is the height of the site above the dry-water course.

It is hypothesized that if the drainage was flowing at the time of prehistoric occupation, then the site will be little elevated above the water source whereas no consistent numerical relationship will be detectable if the drainage was dry.

3.4.10 DISTANCE TO NEAREST PERMANENT WATER (VAR15)

The distance in meters from an archeological site to the nearest straight-line point on a permanent water course was scaled from the map. For the majoirty of sites, this measurement is made to the Arkansas River, the master drainage for the study district. However, an exception was made for those sites along Rule Creek, a perennial stream entering the Arkansas along its right bank. Here sites were found which lie closer to the creek than the river, and in these cases, Rule Creek was taken to be the nearest permanent water. A second perennial tributary is the Purgatoire River, but the survey boundaries were such that no archeological site lay closer to it than the Arkansas. Because the Arkansas River and Rule Creek are the only perennial surface drainages today, it is assumed that they influenced the siting of major base camps, while more temporary fly camps show a distance effect. These relationships are predicted for the Altithermal and Neoglacial periods but will not necessarily hold true during more moist pluvial periods such as the Deglacial and late Glacial times when many of the intermittent drainages may well have been permanent in flow.

Although not included in the computer study of environmental variables, several sites in lower Rule Creek were situated near cliff face seeps. Although these groundwater discharges may have played some part in site selections in the past, still the minimal amount of flow does not suggest that they were ever a significant determinant to decision making. This is especially so because of the more ample and nearby flow of Rule Creek.

3.4.11 HEIGHT ABOVE ARKANSAS (VAR16)

The calculation of this variable is made in the same manner as the measurement for Variable 14. Again sedentary villages and base camps should express close proximity to the river, while short-term, special-activity camps (fly camps) should lie higher above the river.

3.4.12 DISTANCE TO EDGE OF RANGE SITE (VAR17)

Variable 17 is an interval-level measurement of distance in meters from the site to the nearest range site boundary (Fig. 3.2). This measure will scale site locations along a dimension of centrality. Lesser distances will mean that site preference was for a range site ecotone or environmental boundary, while greater distances will indicate a favoring of just that environmental habitat. Ecotone siting offers the advantages of two or more contiguous sets of exploitable resources, while a more central location indicates site selection in order to optimize the resources of a single range site. It is hypothesized that base camps, inhabited by large residential groups over a longer period of time, will favor the multiple-option ecotone, whereas special-activity sites will more often be found centrally located within just one range site.

3.4.13 PERCENTAGE OF DOMINANT RANGE SITE (VAR18)

Variable 18 is calculated using a specially prepared template consisting of a circle 1-km in diameter, ruled off into a 10,000 m^2 grid. The clear plastic template, scaled for the USGS 7.5 minute quadrangle, is centered over the map position of the site so that grid squares for the surrounding range sites can be counted. In this manner the grid count for the dominant range site can be computed as a decimal fraction of the total 1-km-diameter circle. Variable 17 measures centrality of site placement so that sites with high range site values will be located towards the center of single range sites while those with low percentage values will be positioned on or near boundaries of two or more range sites.

3.4.14 NUMBER OF DIFFERENT RANGE SITES (VAR19)

Another measure made from the catchment circle is the count of different range sites occurring within the 1-km-diameter template. A count of one indicates central placement of the site within a single range site with little environmental diversity in site choice. A count of two different range sites indicates increasing preference for environmental diversity with the site located on or near the common boundary of two range sites. A range site count of three or more implies a decision to optimize environmental diversity at the common junction of multiple range sites. Hypotheses to be tested are discussed under Variable 17. The 1-km size of the catchment circle was chosen following the catchment procedure of Grady (1980) to reproduce an hours walk from camp as the optimum distance for collecting nearby food and material resources.

3.4.15 STANDING CROP YIELD (VAR20)

This variable is a measure of potential plant

productivity of a given range site calculated in terms of pounds per acre (air dry) of new growth per year. The SCS Technical Guide (1976) provides the total annual production for each range site in terms of standing crop for favorable years, unfavorable years, and median years. Variable 20 is a record of the median year productivity.

A variety of hypotheses can be tested with this measure. For instance, high plant productivity should be positively correlated with plant-foraging activites for grass seeds, fruits, nuts, and greens. Further, high plant productivity would draw more herbivores, and therefore, predatory human hunters should favor such range sites. Whereas other kinds of site activities, such as lithic resource procurement camps, may well avoid range sites of dense plant cover, and favor those with little ground cover.

3.4.16 GAME ANIMALS (VAR21-28)

The range site descriptions provide an ordinal preference of wildlife for each site. These value ratings are expressed as high (Code 3), medium (Code 2), low (Code 1), and not applicable (Code 0) preferences for Bison (VAR21), Antelope (VAR22), Deer (VAR23), Jack rabbits (VAR24), Cottontail rabbits (VAR25), Elk (VAR26), Upland Game Birds (VAR27), and Waterfowl (VAR28). Nonparametric correlations will be run using the ordinal level measures in order to link specific archeological site attributes with particular animal ratings. This will help identify camps which were set up for hunting certain types of game. Some camps may be associated with the hunting of bison or deer, whereas others may reflect drives, netting, or trapping of the different rabbit species.

3.5 SUMMARY

Man has existed within this area throughout several periods of different environmental conditions. From the waning stages of the Wisconsin glacial period, the Plains have experienced climatic conditions varying from cooler and wetter to warmer and drier than the present, as seen by varying periods of alluviation and dune formation. Therefore, changes in late Pleistocene and Holocene climate should be detected in human-use patterns as well as sediment deposition. The present study, then, is an attempt to define these reflected changes for the eastern portion of the Arkansas River Valley in southeastern Colorado.

In order to assess how man interacted with these varying conditions, environmental variables determining aspects of site location are analyzed in this study. This tabulation is expected to show significant human use patterns according to different climatic phases. For example, drier conditions than present would theoretically reflect habitation clustered nearer sources of permanent water, and the like.

SECTION 4.0
PREHISTORIC RESEARCH DESIGN

by T. Reid Farmer, Frank W. Eddy, and Richard E. Oberlin

The prehistoric research design is presented here in terms of three aspects: 1) regional overview, 2) regional research questions, and 3) questions for the local research. The regional overview traces the cultural history of southeastern Colorado from the Paleo-Indians of 12,000 years ago to the Protohistoric Apaches and equestrian bison hunters of the eighteenth and early nineteenth centuries. This treatment provides an overview taken from existing literature as to what cultures and periods of human occupation are expectable within the John Martin Reservoir.

The section on regional research questions is another literature review covering the range of timely problems of concern to the archeology of southeastern Colorado. This discussion addresses questions having to do with chronological controls, functional lifeway studies, and evolutionary studies.

The third and final subsection presents the core of the John Martin research design, that is the actual research questions employed to organize and direct our investigations. This problem framework is presented as a series of biases covering the problem orientation, hypotheses, data variables, and analytical methods. This organization of research is presented in terms of the Method of Hypotheses Testing following a deductive strategy.

4.1 REGIONAL OVERVIEW

In this brief overview, we will attempt to summarize the known prehistoric sequence for the John Martin Reservoir area. In this study we have of necessity drawn heavily on R. G. Campbell's *Prehistoric Panhandle Culture on the Chaquaqua Plateau, Southeast Colorado* (1969a). His summary of the cultural history for the Chaquaqua Plateau, located immediately to the south of the project area, is presently the best available for the area, even though he does concentrate his work mainly on Late Prehistoric manifestations. Workers in this area seem to have neglected his work in recent years, and we believe that this is an error. Campbell's work forms the general framework for the last 2,000 years on the cultural chronology presented in Figure 4.1.

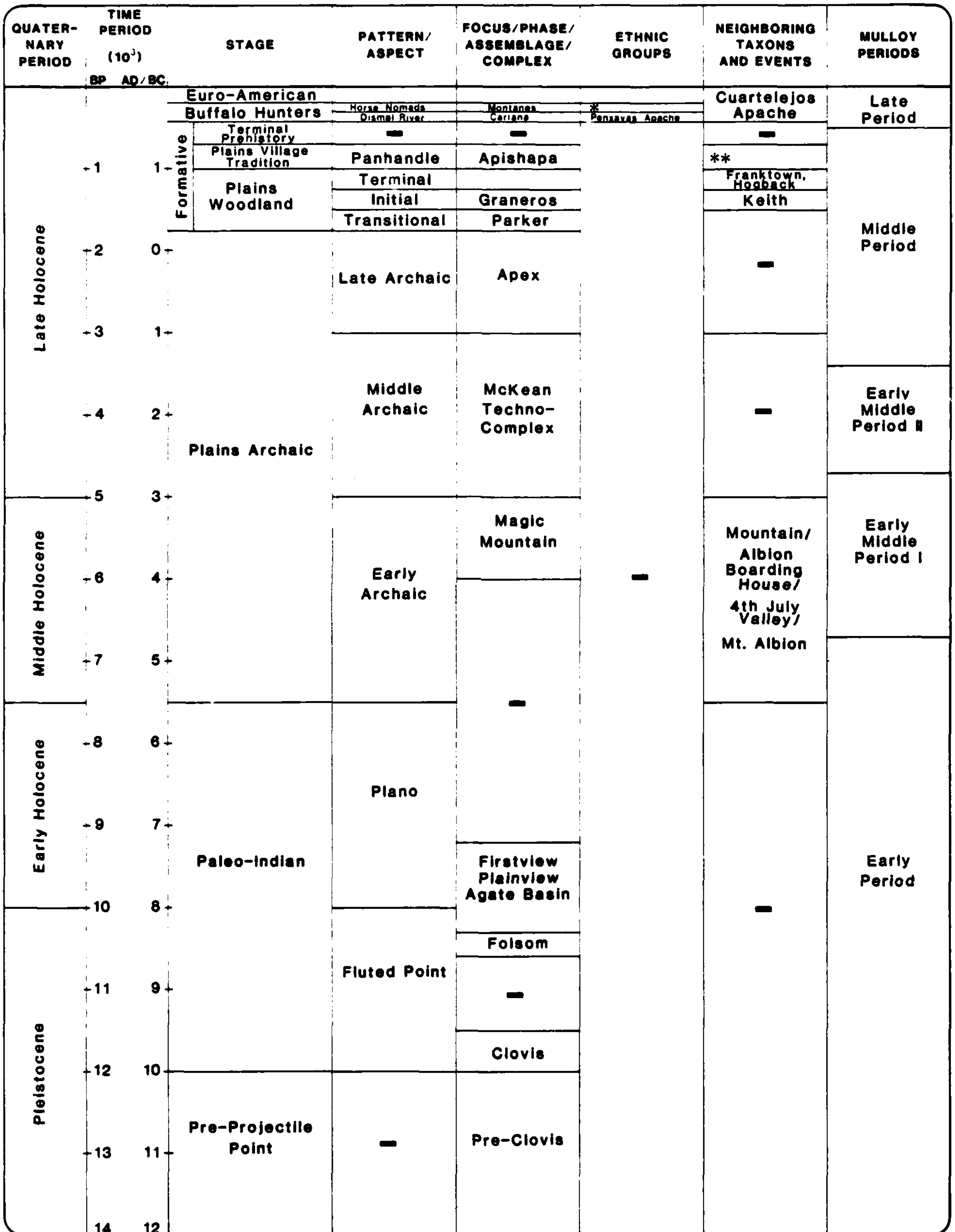
An interesting point that should be realized while studying the prehistory of the John Martin Reservoir is its location near the boundaries of three cultural areas: Central Plains, Southern Plains, and the Southwest. As a result of this, workers from each area have brought their own taxonomic systems and descriptive conventions to bear on this particular area. Thus our cultural history becomes a poorly coordinated melange of the Willey and Phillips (1958) phase systems, the McKern Midwest Taxonomic System, and various ill-defined "complexes." This boundary area situation provides excellent opportunities for studying cultural contact situations, but also creates taxonomic headaches.

4.1.1 PALEO-INDIAN

This period in the project area has been divided into three sub-periods that are named for different cultural groupings. These are: Clovis (10,000-9500 B.C.), Folsom (8600-8300 B.C.), and Plano (8200-5500 B.C.). The Clovis cultures seem to have been associated with mammoth hunting while Folsom and Plano are cultural systems where subsistence centered around hunting extinct forms of bison (Frison 1978).

Clovis assemblages are typified by the distinctive, large-fluted Clovis points named for the discovery area. Sites associated with these materials have been found most commonly in the western plains and the southwestern portion of

FIGURE 4.1
CULTURAL CHRONOLOGY



* Cheyenne/Arapaho/Ute/Comanche/Kiowa

** Sopris/Optima/Antelope Creek/Upper Republican

the United States, but surface finds of these projectile points have been made all over North America. Sites found and investigated have generally been mammoth kills, and Clovis sites of a different functional nature are very poorly known.

The first widely accepted discovery of fluted points associated with mammoth remains was at the Dent site in northeastern Colorado (Wormington 1957: 43). The type station where the points were first named, however, is located within a hundred miles of the project area at the Blackwater Draw locality in northern New Mexico.

As Greiser (1977: 5) and others have pointed out, our perception of Clovis cultural orientation toward mammoth hunting is probably somewhat in error due to the vagaries of preservation. At a mammoth kill site, the concentration of large bones readily traps soils causing rapid burial and preservation. Other sites of a less substantial nature are just not present in large numbers in the archeological record. Most workers with Clovis materials believe that these people used a combination of a hunting and gathering economy and exploited a wide variety of plant and animal resources.

Campbell (1969a: 360) has reported one site containing Clovis materials in Bent County to the south of the project area. One Clovis point was recovered from the site where most of the materials noted and collected dated to a later period. Campbell's descriptions of these Paleo-Indian materials are rather sketchy as his work is oriented toward the Late prehistoric cultures in the area.

Folsom cultures seem to follow Clovis directly throughout the western United States with no dated intermediate forms (Frison 1978). Sites of this culture were originally discovered associated with kills of extinct forms of Pleistocene bison and are marked by the finely made fluted Folsom point. The original Folsom type site is located fifty miles south of the project area in northern New Mexico.

It is during this time period that evidence first appears for the communal hunting of bison (Frison 1978), a practice that was important in Plains subsistence until the near extinction of the great bison herds in Historic times. Herds of bison were driven over cliffs, into deep arroyos, or into small box canyons that formed traps where the animals could be killed. This hunting method means that some degree of social organization and control was present to coordinate the large groups of people needed to effectively perform the tasks necessary for such an enterprise. The tooth eruption patterns in immature bison found in the kills indicates that these communal hunting activities generally took place in the fall or early winter. Behavioral studies of modern bison show that this is the season of the year when the animals herd up and would be most susceptible to the large drives (Frison 1978: 243-250).

The Folsom period hunters were apparently a very successful hunting and gathering adaptation covering a wide geographical area and a correspondingly wide range of environments. Folsom is wide in its occurrence, but the number of large undisturbed sites is rare, in contrast with the more commonly seen surface finds of the distinctive Folsom points.

Excavation of Folsom campsites and kill sites (Frison 1978:115-146) indicates a hunting and gathering subsistence economy that focused on seasonal occurrence foodstuffs at locations within the range of the groups inhabiting the area. It also seems evident that throughout the Paleo-Indian and Archaic periods that human groups were organized at no higher than a band level of social organization (Service 1962).

The band is the simplest and most rudimentary form of social organization and is inferred to be the earliest as well. All functions of the culture are organized and practiced by no more than a few associated bands that are each made up of family units. All organization is based on kinship and there are no religious, economic, or governmental groups.

Populations are low at the band level, with the total population in the vicinity of 100 individuals. This group, often known as the macroband, probably spent only a few occasions together during the year, such as communal bison hunts where larger amounts of manpower were needed. For the remainder of the year, the band split up into family units to avoid too much pressure on scarce food resources.

Campbell (1969a) has reported Folsom materials from two sites on the Chaquaqua Plateau. These artifacts are located on sites which have large, later components. Unfortunately, Campbell reports little other information on sites from this period.

After about 8200 B.C. and lasting until about 5500 B.C., the Folsom occupation is replaced by the Plano Horizon that is marked by the appearance of new types of projectile points. The Plano Horizon seems to have had a similar subsistence base to the Folsom, hunting with a heavy reliance on bison hunting and trapping.

The Plano projectile points differ somewhat from the earlier points, most notably in the attenuation or complete lack of fluting. A variety of types appear, but they are mostly large lanceolate points, with basal grinding and large parallel flaking (Wheat 1972; Wormington 1957). Wheat notes that there are three artifact complexes in the area of this time period, all of which seem fairly equal: Plainview, Agate Basin, and Firstview.

Best known in the project area is the Firstview Complex. This was first named and defined by Wheat at the Olsen-Chubbuck site, located 25 miles north of the project area (Wheat 1972). The Olsen-Chubbuck site is a bison-kill where 190 *Bison occidentialis* were stampeded into an arroyo and killed. These animals were then butchered and processed, though no camp or special processing area was found nearby.

These people are believed to have been organized at the band level, but showed an ability to mobilize manpower at the macroband level for hunting and trapping bison. They also show well-developed trade systems, extensive travel, or both, as a number of the projectile points recovered from the site are made from either North Dakota Knife River Flint or Texas Alibates Flint.

Plano artifacts were found in eight sites on the Chaquaqua Plateau, and seven of the eight are located in canyon areas (Campbell 1969a). Other than this Campbell gives little or no information on sites of this period.

4.1.2 ARCHAIC

The Archaic was ushered in with a long drought period known as the Altithermal. This period of low rainfall and corresponding dessication on the High Plains lasted from 5500-3000 B.C. and has equated chronologically with the Early Archaic Period. A number of workers have postulated a general abandonment of the Great Plains during this period (except perhaps for river valleys) and a movement into the foothills and mountains to the west where conditions were somewhat moister. Benedict (1979) has amassed a large amount of data on radiocarbon-dated sites of this period, and his results point to this abandonment with a corresponding rise in population in mountainous areas. He recognizes three complexes from this period that are located in the central Colorado Front Range (Mount

Albion, Fourth of July Valley, and Albion Boardinghouse) that are apparently ancestral to the succeeding Middle Archaic McKean Complex that occupied the Northwestern Plains.

It is presently unknown if the project area was abandoned during the early Archaic as was characteristic of the rest of the Plains. The Arkansas River Valley may have served as an oasis, allowing continued settlement during this period. Campbell (1969a:364-366) has amassed a fair amount of data on this period of the Chaquaqua Plateau area. However, he defines his Early Archaic as lasting from 5000 B.C. to 500 B.C., thus including our defined period of the Middle Archaic (3000-1000 B.C.). However it is evident that lifeways changed somewhat from the Paleo-Indian period. There was an extinction of the large Pleistocene bison and the emergence of the smaller modern *Bison bison*. Along with this appears a change in emphasis for subsistence toward the gathering of plant foods. Big game hunting was still important but there appears to be more emphasis on small game and an increasing sophistication and emphasis on the gathering and processing of plant foods. Manos, mortars, and other grinding tools appear during this period and were apparently used for plant processing.

Projectile points change during this time period, becoming smaller and presumably being used for atlatl darts. These are stemmed or side-notched and belong to a wide number of styles (Campbell 1969a:101) Among the types present are Abasolo, Trinity, Pandale, and Travis.

Campbell has recorded seven of what he calls early Archaic sites only one of which had a pure Archaic component. He found the greatest concentration of these sites in the canyon areas.

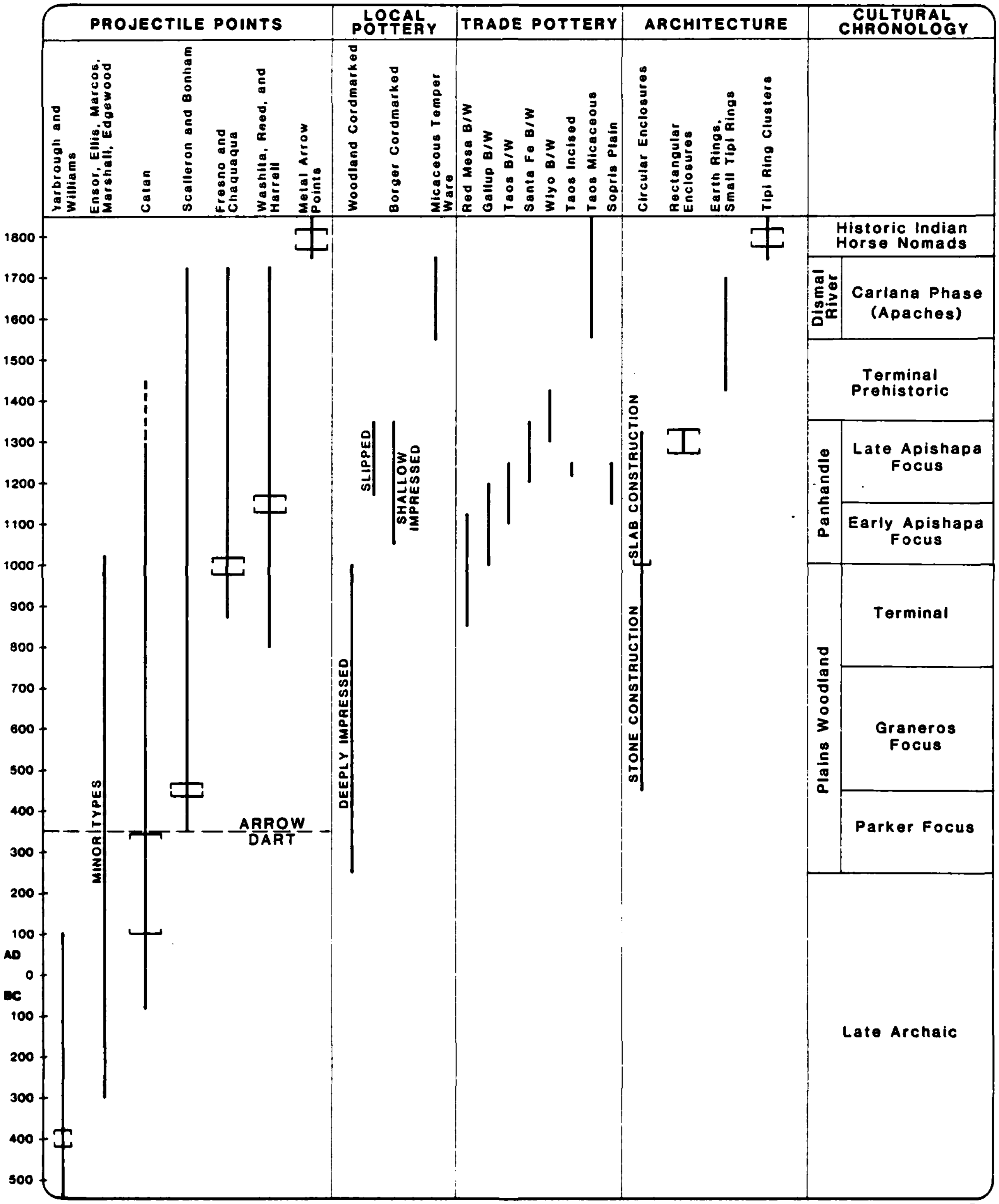
We have defined as a separate period the Middle Archaic lasting from 3000-1000 B.C. In the rest of the Plains, this is the period that is characterized by the reoccupation of the area following the Altithermal drought period. As was mentioned above, Campbell has lumped these two periods, and generally speaking, the two are quite similar in subsistence and settlement patterns, and they are marked by only superficial change in projectile point styles.

The Late Archaic period runs from 1000 B.C. to A.D. 250. During this period the projectile point sytles change slightly but remain basically the same stemmed or corner-notched dart points. Among the types present are Yarbrough, Ellis, Edgewood, Palmillas, Shumla, and Marcos (Figure 4.2). Ground-stone implements increase in frequency, and this seems to imply a further increase in dependence upon plant foods. Campbell (1969a:365) excavated some sites from this period in the area so we have a better picture of the material culture of these people. Faunal remains recovered from these excavations indicate a shift away from the hunting of bison and other big game and a concentration upon small game such as cottontail and prairie dog. No vegetal or seed remains were recovered, but their use is inferred from ground-stone tools. No direct evidence was seen of any sort of architecture. There are a number of trade connections evident from the artifacts recovered. Alibates Flint makes its first documented appearance on the Chaquaqua Plateau during this time period as well as Olivella shell beads. Campbell reports 10 sites dating from this time period, most of which were located in canyons.

4.1.3 PLAINS WOODLAND

The hallmark of the Woodland period in the Central and Southern Plains is the appearance of pottery. Other new material cultural traits that appear at nearly the same time as ceramics are the bow (as inferred from the decreased size of projectile points) and the appearance of substantial architecture. Also, at about this time comes a major shift in subsistence practices with the introduction of maize horticulture.

FIGURE 4.2
TIME DIAGNOSTIC ARTIFACTS AND THEIR AGE RANGES
(Modified after Campbell, 1969.)



DOMINANT TIME PERIOD

The Transitional Woodland period dates between A.D. 250 to A.D. 450 and is, as the name implies, a transitional period where the residents of the area maintained an Archaic lifestyle while gradually adopting some Woodland traits. Campbell has excavated a number of sites from this period in the Chaquaqua Plateau, and we are given a good glimpse into the material culture of the period (Campbell 1969a: 366-370). Campbell sees no discernable hiatus between the Late Archaic and Plains Woodland materials and therefore assumes that there was no major population change or migration at this time. He believes that the native Archaic people gradually adopted some Woodland traits from the east and north and that the introduction of horticulture was the sole revolutionary change during this period of time.

Generally speaking, these are Late Archaic sites with a few Woodland artifacts present. Projectile points are mostly Archaic in style and consist of Catan, Kent, Ellis, and Yarbrough dart points, but small Scallorn arrow points make their initial appearance here (Figure 4.2).

The ceramics present are deep cord-marked wares that appear to come from conoidal vessels. Campbell's investigations turned up only body sherds. These ceramics are very similar to those of the Parker Focus (Withers 1954) that have been defined in the south of the Denver Basin for about this time period.

There is an increase in ground-stone artifacts and an inferred increase on the dependence upon plant foods. No direct evidence of maize horticulture was located, but Campbell believes that it was introduced during this period of time.

There is no evidence of Transitional Woodland architecture of any sort for this time period. However trade connections continue as evidenced by artifacts made of Alibates Flint and of obsidian. Both of these seem to indicate communication with the south and west, while the introduction of Woodland traits argues for ties to the north and east where Plains Woodland cultures were prominent on the Central Plains.

Campbell lists six sites that date from this time period. Five of the six are sheltered encampments facing south and located in canyons.

Initial Woodland dates from A.D. 450 to 750. During this period, the variety and number of all archeological materials increases markedly. Projectile points show a further shift toward the use of the bow, and those points collected appear to be split evenly between arrow and dart points. Arrow points are Scallorn, Alba, Young, and Fresno while dart points are Catan, Marcos, and Ellis.

More ceramics are present than in the Transitional period, but sherds are still somewhat scarce. These are cord-marked, and similar to the ceramics from the previous period.

Faunal remains excavated from these sites indicate that there is a shift back toward the hunting of larger game, such as bison and deer. Plant remains were recovered from sites of this period, and these indicate the use of plums, gourds, and pinon nuts. This is no direct evidence of maize agriculture from the area, but Campbell (1969a: 370-377) infers its presence and believes that the lack of evidence is due to the vagaries of preservation.

One strikingly new development during the Initial Woodland period is the appearance of substantial architecture. Nearly half of the sites recorded for the period are stone enclosures, which are low, horizontally-placed, dry-laid, slab foundations, with a circular plan 8 to 15 ft. in diameter. Stone is piled in uncoursed tiers 1 to 3 ft. above the surface. There appears to be a preference for the slab-like rocks and broken

metates sometimes used in this construction. These enclosures appear to be foundations for a perishable structure, but the form of this structure is not certain. Campbell found no evidence of postmolds in any of the enclosures that he excavated. Most of the sites are isolated single enclosures, but three sites have three adjacent rooms each and two have a single, large oval-shaped enclosure that is partitioned into rooms.

This settlement pattern appears to reflect small farmsteads occupied by family units. Each family unit probably had its own small territory for agriculture and wild-plant gathering. Larger social units probably gathered regularly for communal bison hunting and ceremonial activities.

Near the end of this period of time the stone enclosures seem to increase in number and size. One site that dates to the very end of the period has 11 rooms. This would seem to indicate a great agglomeration of population and possibly a resultant increase in the level of social organization and complexity.

It appears that at this period of time the inhabitants of the study area may have moved to a slightly higher level of social complexity than the band: the tribal level (Service 1962). Bands and tribes are similar in that they are both kinship based and egalitarian in nature. Tribes, however, have new forms of integration, such as sodalities, that bands lack, and they have greater specific diversification. However, the structures of tribes have not been differentiated to the point that there are separate mechanisms for religion, political control, or economic specialization. Tribes do have much larger populations. They are characterized by segmental structure, wherein residential units are alike, economically self-sufficient, and largely autonomous. This seems to fit quite well with the picture we have for the period of small prehistoric farmsteads throughout the area.

It seems unlikely that any groups in the area ever had higher than a tribal level of organization during the prehistoric era.

Campbell believes that this manifestation is a variant of the Graneros Focus that has been defined for Woodland sites of this period in the Pueblo area (Withers 1954; Hunt 1975; J. Anderson 1976). Sites of the Graneros Focus show similar architecture, ceramics, and settlement pattern and appear to be closely related to the occupations in the project area and the Chaquaqua Plateau.

Campbell reports a total of 47 sites dating from this time period in the Chaquaqua Plateau area. This reflects a population increase, possibly as a consequence of the increased maize agriculture.

The Terminal Woodland Period lasted from A.D. 750 to 1000 and is marked by the continued adoption of settled life and typical Woodland traits. Projectile points, for example, show an overwhelming adoption of the bow, with arrow points making up a total of 88% of the total collections. Scallorn are the most common points, but Chaquaqua, Fresno, and Huffaker points are also present (Figure 4.2).

According to Campbell, for the first time in the area, direct evidence of maize is found. Other plant foods that were recovered were wild plum and gourds. An increase in the presence of manos and metates also show this increased emphasis on the use of plant foods. Faunal remains show a decline in the hunting of big game animals, and the faunal assemblage is dominated by small animals such as cottontail and prairie dog.

Architecture changes very little in style, and settlement pattern continues in the trend set near the end of the last period, with the agglomeration of population into settlements of slightly larger size. During this period there is usually more

than one structure at each site. A side effect of the increased population in the area may have been intergroup warfare. For the first time defensive barrier walls appear on sites. During the Terminal Woodland, most of the sites occur in the upper canyons on the Chaquaqua Plateau. Thirty-three sites were found dating to this period.

During the Terminal Woodland, ceramics remain basically unchanged from the preceding period. On all sites, sherds remain rather uncommon. However, near the end of the period ceramics change slightly to a shallower cord-marked form. (Figure 4.2).

4.1.4 PANHANDLE ASPECT

Beginning at about AD 1000 and continuing until about 1300 the area is marked by great cultural change with the advent of the Panhandle Aspect culture that was derived from groups located in the areas of the Oklahoma and Texas Panhandles (Campbell 1969a:389-402). In the study area this manifestation has been termed the Apishipa Focus, and it does appear to be related to the Optima and Antelope Creek Foci in Oklahoma and Texas. With this period, comes a noticeable increase in the number of sites and the amount of archeological materials. This apparent increase in population seems to be based on the heavy reliance upon maize agriculture as a food source along with a climatic maximum giving relatively large amounts of rainfall to help support this agriculture (Wood 1972).

Excavations show that five varieties of maize were raised in the area. Galinat and Campbell (1967) have presented evidence to support their assertion that the Arkansas Valley was an important area during this period of time for the hybridization of new varieties of corn. These new, more productive varieties had their original source in the Southwest and later were traded down the Arkansas Valley into the Southeast, where Galinat and Campbell believe that they were a factor in the Late Mississippian Culture florescence.

In addition to corn, evidence shows that beans were raised. A number of wild plant foods show up in the archeological record: chokecherry, wild plum, yucca, various cacti, and various grass seeds. Faunal remains show a return to hunting large game.

Architecture changes slightly in that dry-laid walls become uncommon and the enclosures are made of slabs set in the earth. Most rooms are single units and shapes are oval, semicircular, and D-shaped, although most are still circular. There is continuing evidence for population concentration and an increasing emphasis on defensive works and locations. Sites are increasingly located on inaccessible mesa tops and other eminences. Barrier walls are more common.

Projectile points show an increasing trend away from the use of the atlatl toward use of the bow. By far the most common points are Washita and Reed arrow points, but some Catan dart points are still in evidence. Ceramics change during this period of time and show a shift away from the conoidal-shaped, cord-marked Woodland types. New pottery has the narrow, shallow cord-marks of the Borger and Stamper Cord-Marked varieties that are common in the Panhandle Aspect Foci of Texas and Oklahoma. In addition there is a shift to more globular shaped vessels (Figure 4.2).

Campbell documents increased communications and trade on the part of the Apishipa Focus inhabitants of the area (1969a:401). Alibates Flint, obsidian, and marine shell all appear in larger quantities than ever before. In addition, there is evidence of increased contact with the Rio Grande Pueblos, as Puebloan

black-on-white trade wares appear at this time.

Campbell records 68 sites dating to this time period in the area which illustrates the large increase in population during the period.

4.1.5 TERMINAL PREHISTORIC

This period is initiated by a large drought that affected the Southwest and the Southern Plains near the end of the thirteenth century A.D. (Wood 1972). This Great Drought apparently made maize agriculture in the project area impossible and caused the abandonment of the area by the Apishapa Focus peoples. Campbell located a total of only three sites that date to this A.D. 1300-1550 period of time. Campbell (1969: 402-408) believes that the few people who stayed in the area retained some sort of affiliation with the Panhandle Aspect cultures to the southeast. No bison remains were found on any of these sites, but a wide range of other large and small game animals were hunted. Agriculture seems to have been abandoned.

Ceramics remained in use and are a continuation of the earlier cord-marked series. However, there is the appearance of some smudged wares that are very reminiscent of Upper Republican ceramics known from the northern part of the state. The most common projectile point type is the Washita arrow point.

4.1.6 PROTOHISTORIC

The Protohistoric Period is ushered in with the arrival of the first Spanish explorers in the region in the middle of the sixteenth century A.D. and lasts until the period of regular contact with the Spanish colonies in the Southwest, about A.D. 1750.

The beginning of this period is also marked by the occupation of large areas of the South and Central Plains by the Plains Apache. This was the termination of a great migration of Athabascan-speaking peoples from what is now western Canada into the Plains and the Southwest. Archeologically, these Plains Apache are known as the Dismal River Aspect (Gunnerson 1960). In southeast Colorado, Bair (1977) has named this Apachean occupation the Carlana Phase. These Apachean occupations have the distinctive presence of thin, dark, micaceous-tempered ceramics. These take the form in the project area (and in northeastern New Mexico) of Ocate and Cimmarron Micaceous.

Campbell notes that during this period of time Fresno points are most common, but Washita, Reed, Huffaker, and Scallorn points are all present (Figure 4.2). Faunal shows a range of all sizes of game from bison on down. No plant remains were recovered in any of Campbell's (1969a:408-412) excavations, but the Ulibarri expedition which passed through the area in 1706 noted that Apache were growing corn, beans, and pumpkins. Of the 10 sites Campbell has dating to this time period, 6 are located near arable land on floodplains. He believes that these are small, seasonal, horticultural villages.

Elsewhere in the Plains, Dismal River architecture is marked by earth-lodges with a distinctive five-post roof support (Gunnerson 1960). However, no architecture of any kind dating to this period was seen on the Chaquaqua Plateau.

In the late 1720s, the Apache apparently abandoned the area of southeastern Colorado, under pressure from a southward migration by the Comanche (Buckles 1968). This ushered in the occupation of the Southern Plains by the horse nomads of the Historic Period.

4.1.7 SUMMARY

This Regional Overview is a summary of the literature for the prehistory and aboriginal

history of southeastern Colorado. As such, it provides a background for sections to follow which will deal with Regional Research Questions and the John Martin Research Design, itself. The Prehistoric Overview was presented in terms of the succession of cultural stages including: Paleo-Indian, Archaic, Plains Woodland, Panhandle Aspect, Terminal Prehistoric, and Protohistoric as summarized on chart, Figure 4.1. This stage sequence reflects some 12,000 years of cultural evolution extending from the late Pleistocene mammoth hunters to the historic horse-mounted bison hunters.

4.2 REGIONAL RESEARCH QUESTIONS

Two research domains will be examined here which will be the basis for the research design. In particular, the essays to follow will provide the background for our treatment of the sections entitled Problem Orientation, Hypotheses, and Field Methods. The research domains of concern are the functional and evolutionary aspects of the prehistoric archeology of southeastern Colorado in general and the John Martin Reservoir in particular. However, before we consider these topics, it is helpful to review the need for chronological control of the data as it is critical to studies of change and persistence in paleo-environment and past cultures. Without dateable sites and artifacts, a useful data base is lacking for either functional lifeway or evolutionary studies. Therefore, an evaluation of the strength of chronological control is paramount before attempting more sophisticated domains of research. For example, a consideration of functional lifeways of past human communities can only be completely effected when time is held constant so that formal variability can be examined along a spatial (geographical) dimension. This operation involves establishing form-space units while zeroing out time (Spaulding 1970). Obviously without temporal control, formal data such as settlement and technological information cannot be plotted on isochronic maps, used to observe variability and organizational relationships on a synchronic plane. Similarly, evolutionary studies, which are diachronic in nature, require dateable sites and artifacts so that temporal growth and development can be measured. Adaptation, which is taken to be the primary causal mechanism in cultural evolution, can only be examined when environmental events are dateable in an historical sense. Only the requisite temporal control will provide us with a well-defined [illegible]al and cultural chronology of the John Martin data.

4.2.1 ASSESSMENT OF CHRONOLOGICAL CONTROLS

Presently, the cultural chronology rests on dating which has been effected within the surrounding southeastern Colorado region. Relative placement of sites and artifacts is based on stratigraphic studies and particularly the rock shelter stratigraphy on the Chaquaqua Plateau immediately to the south of John Martin. Here Campbell (1969a) and Simpson (1976) have excavated multiple component shelters extending from late Archaic to Historic times yielding a relative chronology of considerable comparative value.

Campbell (1969a) has converted this relative sequence into an absolute chronology in which events are dated in terms of age-in-years by several means. One absolute technique is the use of radiocarbon dates to measure the duration of individual cultural events. As an example, he is able to assign the Transitional Woodland, Parker Focus to a 200-year bracket age range between A.D. 250 and 450 (Figure 4.1). But uncertainties are present in this radiocarbon-based chronology. For example, the dating of the Apishapa Focus and its maize agriculture is in part a function of C-14 dates obtained directly on corn plants. It is known that *Zea mays* or Indian maize differentially fractionates in such a way that it favors the uptake of the heavy

isotopes of carbon in its photosynthetic processes, thereby skewing the age results. To what extent, then, can we rely on the validity of the corn-derived radiocarbon dates from the Medina and Pyeatt sites of the Chaquaqua Plateau (Galinat and Campbell 1967)? Other uncertainties of radiocarbon dating are the need for recalibration (Wilson 1976) and inaccuracies of the older, solid carbon dates. Similarly, rock shelters are notorious for mixing of deposits through overturn by rodents and humans. For these reasons, an important research question to be asked concerns the validity of radiocarbon dates throughout southeastern Colorado, as recently reviewed by Butler (1980).

A second means of absolute dating is the use of stylistically distinct artifact classes which have been dated elsewhere by stratigraphy, dendrochronology, and/or radiocarbon dating. Projectile points are an outstanding example of a timesensitive artifact class which is useful as a cultural guide fossil when found in association with artifact complexes and assemblages (Figure 4.1). Examples of such dateable stylistic seriation are the Paleo-Indian lanceolate points (10,000-5500 B.C.), Archaic notched and stemmed points (5500 B.C.-A.D. 250), and post-Archaic corner, side-notched, and unnotched points (A.D. 250-1860). After A.D. 250, the Transitional Woodland sites contain arrow tips such as Scallorn and other named types in addition to the atlatl darts. By A.D. 1750, metal arrow points are indicative of the Historic horse nomad buffalo tribes (Figure 4.2).

As one scans the local-sequence chart of Figure 4.1, it is apparent that preceramic point chronologies provide variable precision to time control. The earlier lanceolate and notched points rarely contribute control on natural and cultural events as fine as a millenium. However, as one ascends the chronology to Woodland-ceramic times, the degree of precision increases dramatically so that temporal control is tightened to the level of centuries rather than millenia.

Another class of artifactual guide fossils is pottery (Figure 4.2). Village Formative sites, first appear in southeastern Colorado around A.D. 250. These small farmsteads are dateable by the presence of a few sherds of deep, cord-marked ceramic vessels, the hallmark of the Parker Focus (Figure 4.2). Shallow, cord-marked vessels appear after A.D. 450 to indicate the shift to the Graneros Focus and the Terminal Woodland Period. The succeeding Apishapa Focus of the Plains Village tradition exhibits ceramic guide fossils of Borger and/or Stamper cord-marked sherds which first make their appearance after A.D. 1000. New surface treatment on these types, including slipped, smoothed, and polished finish, is noticeable after A.D. 1175. Vessel smudging is characteristic of the Terminal Prehistoric Period (A.D. 1350-1550) followed by several micaceous pottery types (Ocate and Cimarron) which define the Plains Apache proto-historic period (A.D. 1550 - 1750). Although radiocarbon dating has verified the age assessment of these stylistically-defined pottery types, the real strength of their temporal assignment is provided by association with southwestern trade ceramics. These in turn are comparatively well dated in their Upper Rio Grande Source area (Breternitz 1966). Most of the pertinent trade ceramics come from the Taos, New Mexico area although Gallup B/w (A.D. 1000 - 1200) was transported from as far away as Chaco Canyon in northwestern New Mexico. The pertinent Taos-area decorated trade wares are: (1) Red Mesa B/w (A.D. 850-1125), (2) Taos B/w (A.D. 1150-1250), (3) Santa Fe B/w (A.D. 1200 - 1350), and (4) Wiyo B/w (A.D. 1299 - 1425). These black-on-white (B/w) decorated ceramics provide temporal control on the order of centuries to the Woodland Period, whereas surface-textured types appear after A.D. 1200 to date the Apishapa Focus, Terminal Prehistoric, and Proto-

Historic. Named types are Taos Incised (after A.D. 1200 to just before A.D. 1250) and Taos Micaceous (A.D. 1550 - present) (Ellis and Brody 1963). In addition, corrugated and plain coil Sopris Phase pottery is useful for dating the late Apishapa Focus (Bair 1977:12; McCabe 1973:Table 4).

In summary, the cultural and natural chronologies of southeastern Colorado, as illustrated on Figures 3.1 and 4.1, display a sliding scale of temporal control. The chronologies for the pre-Formative sequences prior to A.D. 250 are fairly gross, measuring time in units of a millenium or more in length. With such a coarse framework, it is obvious that only large-scale events can be detected. In contrast, the Formative occupations after A.D. 250 are much more precisely measured on the order of centuries, allowing the possibility of detecting short duration events such as the Great Drought of the late thirteenth century, the appearance of eight-rowed maize, the Apishapa Focus population peak, the appearance of the Athabascan-speaking Apaches, periodicity of bison herds, and other natural and cultural events of critical concern. A research question of the first order, then, is the refinement of chronological controls for the prehistory of southeastern Colorado.

4.2.2 FUNCTIONAL LIFEWAY STUDIES

In functional studies, archeological remains are analyzed as evidence of past behavior (Schiffer 1976). In order to do so, only the occupational debris of one age is considered. The usual procedure is to plot the distribution of sites and artifacts on isochronic (same time) maps to define patterns of settlement and land-use practices for each prehistoric period. For it is the assumption of the Materialist that subsistence practices will causally determine forms of human organizational behavior and that these will be revealed by the study of distributional data (Harris 1969; Hodder and Orton 1976).

For these reasons, our research questions are focused on the roles of subsistence practices, exploitive technology, and environmental resources in shaping the economic basis of society. The interaction between these variables forms the basis for cultural adaptation, which is the primary causal mechanism in the function and evolution of societies. Accordingly, some of the research questions which are critical to functional studies at John Martin concern the role of subsistence practices including: (1) big game hunting, especially of bison herds; (2) intensive foraging of wild-plant products; (3) stalk and ambush of modern, medium-size game; (4) trap and snare of rabbits, rodents, and waterfowl; and (5) food production based on corn, beans, and squash horticulture. When we learn the part that these forms of subsistence adaptation played in the lives of ancient peoples of the John Martin Reservoir, then it will be possible to explain the nature of settlement networking, human population size and density, the nature of human social organizations, and regional and inter-regional trade (see Hypotheses). Furthermore, insight can be gained into such matters as rock art which likely played an important role in group identity and ritual. Matters of internecine warfare will also be examined from the Materialist perspective that population pressures generate conflict through competition over scarce and finite resources.

4.2.3 EVOLUTIONARY STUDIES

In order to study diachronic change and persistence in societies, it is necessary to examine the transformations which have occurred between each sequential functional lifeway of the prehistoric past. This approach may be accomplished by a macroscale analysis of change between sequential cultural stages such as the Paleo-Indian, Archaic and Formative sequence

(Figure 4.1). Or a microscale analysis may be conducted by considering cultural transformations between periods such as the Woodland Pattern in the sequence of Transitional, Initial, and Terminal Woodland (Figure 4.1).

Whichever scale of evolutionary study is considered, macro- or micro-, certain basic research questions need to be asked. These have to do with the changing role of adaptation as the prime causal mechanism for driving cultural systems towards more complex organizations and more efficient energy extraction. In our discussion of functional studies, we defined adaptation as the interaction between a culture and its natural environment, as revealed by subsistence practices. For evolutionary purposes, it is necessary to expand this definition to include adaptation not only from the standpoint of a community functioning within the context of a natural environment, but also the interrelation of this community with its surrounding cultural neighbors. In this enlarged definition of adaptation, social adjustments involving warfare and economic exchange between one society and another are of prime concern.

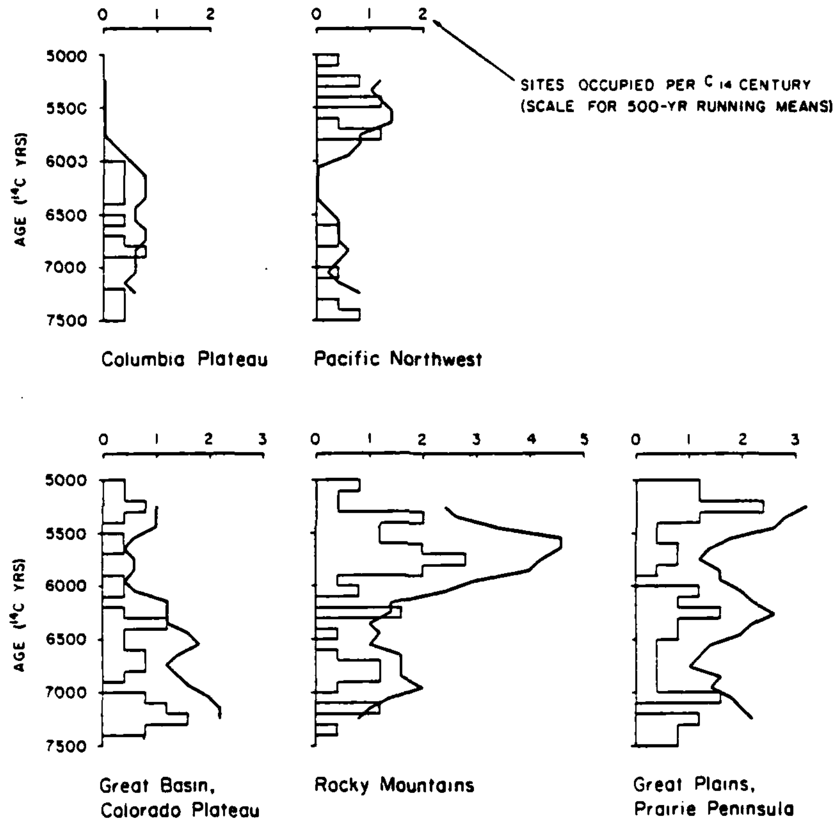
Evolutionary research questions, then, will inquire into the role of the changing natural environment and the effect of such events as drought, alluviation, drainage, entrenchment, dune-field activity and stability, soil formation, and climatic change (Figure 3.1). Much of this investigation will be drawn from reconstructions of regional environments, but some primary observations were effected by the project geologist (Appendix A). Other aspects of the natural environment which we anticipate will show an effect on human settlement and land use are periodicity in bison herds (Dillehay 1974), terminal Pleistocene and Altithermal faunal extinctions, and changing stream discharge as governed by the Pleistocene and Neoglacial history of snow cover on the continental divide, located to the west of the study district (Benedict 1973).

An example of an environmental and evolutionary research problem has been formulated by Benedict (1979). He has advanced the thesis that during the Altithermal Long Drought, which he sees as having taken place during two episodes of warm, dry climate, human settlement left the dessicated High Plains to take refuge in the more mesic continental-divide area of the Rocky Mountains. The effects of drought-reduced late winter/early spring precipitation are as follows: (1) reduced short-grass prairie forage, (2) diminished bison herds, and (3) emigration of human bison hunters as the carrying capacity collapsed. Conclusions regarding human migration from the Plains into the Rocky Mountain refugia are all based on population trends exhibited by histograms of the number of archeological sites occupied per radiocarbon century. Such data plots display an inverse relationship; population peaks and troughs on the High Plains are out of phase with those of the Rocky Mountains (Figure 4.3). And in fact other xeric areas throughout the western United States were also being abandoned in favor of upland, mesic habitats which served as refuges until the Long Drought ended about 5000 B.P. To test this hypothesis, the Plains situated John Martin Reservoir district will be searched for the requisite early Archaic data. If site-component count and density are high in comparison with either the preceding Plano occupation or the post-Altithermal occupation of middle Archaic times, then Benedict's refuge hypothesis must be rejected. However, if a population minimum can be defined for the Altithermal and early Archaic, then his hypothesis must be accepted. Other, more generalized research questions concerning human adaptation to the changing natural environment are specified in Hypotheses 1.0 through 1.6.

FIGURE 4.3

POPULATION TRENDS IN WESTERN NORTH AMERICA DURING THE ALTITHERMAL

JOHN MARTIN RESERVOIR PROJECT



Histograms show the number of archeological sites occupied per radiocarbon century in each of five geographic regions, based on charcoal and bone collagen dates available in 1978. The heavy lines are 500--year running means (Benedict 1979:fig. 2).

The role of social adaptation will be examined through an investigation into intercommunity conflict and economic exchange. Warfare is suggested by Campbell (1969a) for the Chaquaqua Plateau district based on his finding of Apishapa Focus sites situated on inaccessible buttes and eminences which are seemingly defensible positions. Some evidence is present for fortifications and, in fact, elsewhere on the Great Plains, there is evidence of stockaded villages and skeletal evidence of violence from A.D. 1000-1350. It is revealing that Campbell (1969a) recognizes a peak in site-component count and density of habitation just at this time which may well be causative in generating internecine conflict. Other examples of social adaptation through warfare are revealed by historic accounts of tribal skirmishes among the Jicarilla Apache, Comanche, Utes, and the Cheyenne/Arapahoe. Conflict will be examined in the John Martin study in terms of Hypothesis 2.7 and 8.

A second class of social-adaptation research questions has to do with the effects of trade and diffusion on John Martin resident populations. Based on the regional picture of southeastern Colorado prehistory, it is known that long enduring networks of exchange were present. Specifically, the presence of exotic southwestern pottery derived from the Taos area of the Upper Rio Grande is indicative of persistence in overland barter. Since the frequency of trade pottery is higher in the Trinidad area of the Park Plateau than it is on the Chaquaqua Plateau, it seems likely that the exchange took place in a leapfrog fashion so that trade pottery moved from Taos to Trinidad first. Next it moved from the Pueblo Sopris Phase of the Trinidad area down the Purgatoire River to the Chaquaqua Plateau and thence to the John Martin area. Judging from the temporal distribution of the trade pottery, this exchange network could have been in effect from A.D. 850-A.D. 1750, crosscutting many different prehistoric and protohistoric cultural traditions.

Other exotic materials indicating social adaptation through barter exchange are marine shell and crypto-crystalline knapping material. The shell, most of which is Olivella obtained from the Pacific Ocean, must have been exchanged from southwestern Indians. Campbell (1969a) also believes that exotic obsidian found on the Chaquaqua Plateau was traded into southeastern Colorado from the Upper Rio Grande. However, alibates chert comes from a different source. Chaquaqua sites containing this exotic flakeable stone give good indication of trade with a lithic source area lying between the Cimarron and Red Rivers of the Oklahoma-Texas panhandle area, located to the southeast of John Martin Reservoir (Lintz 1978).

In summary, important research questions ask to what extent the John Martin prehistoric peoples participated in these two regional exchange systems and in what ways this economic exchange generated an evolution in prehistoric culture.

A final evolutionary research problem concerns the role of maize food production and the domestication history of this important crop in effecting the shift from mobile Archaic foraging cultures to sedentary village Formative cultures. In general, the assured and plentiful food supply generated by maize horticulture is thought to be responsible for sedentary village life. As a rule, the appearance of the bow-and-arrow and fragile ceramic vessels for cooking, food and liquid storage, and food service are both traits associated with village agriculture; this cultural pattern is called the Formative Stage (Willey and Phillips 1958). In southeastern Colorado, the early Formative is expressed as the Woodland Period which first appears as the Parker Focus dated between A.D. 250 and 450. Presumably, the shift from the late Archaic foraging subsistence pattern to

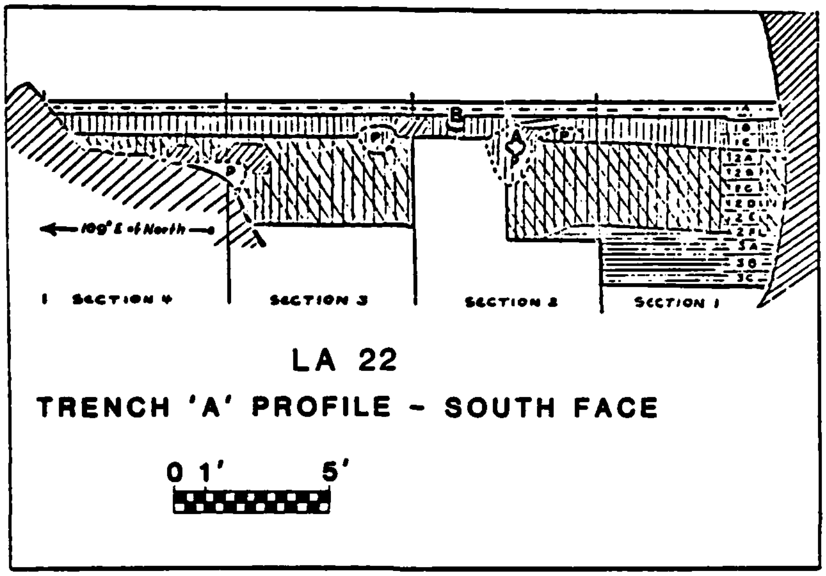
the Parker Focus village sedentism was based on corn cropping but direct evidence, according to Campbell (1969a), is lacking. In fact, Campbell claims that evidence for horticulture, including corn, beans, and squash or gourds, is not definitely present until the Apishapa Focus around A.D. 1150 where it has been radiocarbon dated in Medina and Pyeatt Rock Shelters on the Chaquaqua Plateau (Galinat and Campbell 1967). By his account, then, we cannot relate the appearance of a Formative lifeway to food production in southeastern Colorado.

However, when we actually inspect the raw stratigraphic data on which Campbell's (1969:133-145) conclusions are based, a somewhat different picture emerges. In Medina Shelter (2LA22), Level 1 contained the heavy concentration of cultigens (Figure 4.4). This layer was subdivided by Campbell into three subunits: 1A, 1B, and 1C. Subunit 1A consists of prehistoric perishables mixed with recent Historic homestead domestic-animal dung and artifacts. Underlying Level 1B is uncontaminated. It contains cultigens of which an eight-rowed corn cob of the Harinosa de Ocho race yielded a radiocarbon date of A.D. 1140 ± 85 (Campbell 1969a:145). It is based on this assay that the appearance of corn horticulture is dated to the Apishapa Focus and not earlier. However, further inspection of the data reveals that some corn was also removed from the lowest part of Level 1; that portion he calls Level 1C. And furthermore, text and Figure 14 reveal that another radiocarbon assay was obtained; one that comes from a pit-fire hearth dug aboriginally from the contact surface separating Level 1 from underlying Level 2. This date of 20 B.C. ± 100, according to Campbell, marks the beginning of Level 1C deposition. It seems clear to me that the corn of Level 1C is well bracket dated between these two assays, and we have here evidence that corn horticulture extends much further back in time than Campbell admits. In fact, corn horticulture must extend as far back as late Archaic times, in which context, it provides a good and sufficient explanation for the rise of village farming in southeastern Colorado dating from the very beginning of the Woodland pattern.

These findings are very consistent with the diffusion history of corn. From a center of domestication in central Mexico (MacNeish 1964), where corn is dated to 5,000 B.C., there is a steady and consistent lapse rate in the appearance of corn spreading northward towards the southwestern United States. In a middle Archaic context, southwestern corn in Bat Cave, New Mexico, is dated to 2300 B.C. (Dick 1965). From here its continued diffusion transmittal into southeastern Colorado seems very reasonable, arriving in a late Archaic context around the time of Christ or just before.

Galinat (Galinat and Campbell 1967:Tables II and III), a botanist, who has reconstructed the races of maize and their history, has identified five kinds of corn from Medina and Pyeatt Rock Shelters. These are: Maiz de Ocho (Harinosa de Ocho), Maiz de Ocho-mix, Pima-Papago (Basketmaker), Chapalote-Reventador, and Tripsacoid unidentified. Of these, all are present throughout Level 1 of Medina Shelter except the Chapalote-Reventador which is absent from subunit 1C. Within the range of this maize diversity, the flour Maiz de Ocho race is important because it is most common and "its spread conferred benefits in the form of higher productivity, easier milling and adaptability to the high altitudes of the Southwest as well as eventually to the high latitudes of the North and Northeast" (Galinat and Campbell 1967:6). It is the thesis of Galinat and Campbell that this eight-rowed corn race was bred in the Upper Rio Grande, and from there it moved via the Chaquaqua Plateau down the Arkansas River into the lower Mississippi around A.D. 1150 to effect the florescence of the late Woodland Mississippian culture. However, from our standpoint, Maiz de Ocho has the most important effect in improving local food production through its high yield. This resulted in the

FIGURE 4.4
STRATIGRAPHIC CROSS-SECTION OF MEDINA SHELTER (LA22)
JOHN MARTIN RESERVOIR PROJECT



Organic Sands
Brown Carbonaceous Soil
Red Ferrous and Carbonaceous Soil
Gray Calcareous Soil
Bedrock
Pit Hearth
Radiocarbon Samples:
A. 20 B.C. ± 100
B. A.D. 1135 ± 85

Gives the radiocarbon dates which bracket the appearance of corn. Note that C-14 assay B is very slightly at variance with the age value given in the text (Campbell 1969:fig. 14).

generation of peak human populations during the Apishapa Focus in the twelfth century.

In the John Martin research, it has not been possible to directly evaluate the maize hypotheses of Campbell and Galinat since perishables are rarely preserved on open lithic sites. Further, testing in an occupied rock shelter and Formative house did not reveal dry or charred cultigen remains (Section 5.6). However, their thesis is of concern to the John Martin investigations as a hypothetical explanation for the appearance of Formative sedentism and village architecture.

4.2.4 SUMMARY

The prehistoric research questions are organized according to two domains of investigation: functional lifeway and evolutionary topics. In order to effect either kind of investigation, it is first necessary to assess the precision and reliability of chronological control on the environmental, functional, and evolutionary data. Relative dating for southeastern Colorado is based on the rockshelter excavations conducted on the Chaquaqua Plateau. This chronology is converted to an absolute age-in-years sequence by means of radiocarbon and stylistically distinct projectile points and pottery as summarized in Figure 4.2. Using all of this temporal evidence, the regional natural, and cultural chronologies of Figures 3.1 and 4.1 were constructed. Inspection of these figures reveals a changing scale of chronological precision. Prior to A.D. 250, the dating of natural and cultural events is quite gross, with measures of time on the order of a millenium or more. However, after this date, the natural and particularly the cultural chronology is refined to a precision of centuries.

Given the limitations of this chronology, it is the intent of the Research Design to plot data on isochronic maps which would define patterns of prehistoric settlement and landuse by each time period. In this manner, the nature of past lifeways and, in particular, subsistence practices which formed the material base of society can be explored. If it is found after an examination of the chronological data that too few prehistoric sites can be dated, then the depth of functional analysis will be seriously affected.

Similarly, evolutionary studies based on diachronic data require a tight time control. Studies of growth and development can be accomplished at the macroscopic scale by examining the transformation between one cultural stage and another in the sequence; Paleo-Indian, Archaic, and Formative. Microscopic evolution can be investigated by analyzing the growth transformations within time periods, such as the Transitional, Initial, and Terminal subdivisions of the Woodland Period. An example of an Evolutionary research question to be examined at both the macro- and the micro-scale is the role of the natural environment in generating prehistoric culture change. More specific questions concern the effect of changing climates such as the Altithermal long drought and periodicity in game populations, including bison, as these affect subsistence practices. The role of social adaptation will be inspected through intercommunity conflict and trade exchange. And finally, the role of corn horticulture in generating sedentism and village life will be considered. However, the degree to which we can investigate any or all of these research problems will depend upon whether or not the archeological data base will yield the requisite temporal and adaptive information.

4.3 JOHN MARTIN RESEARCH QUESTIONS

Today most archeologists would agree that data is to be collected and analyzed within the orientation of research problems rather than within a vacuum. By way of contrast, the nineteenth century natural historian entered the field simply to observe without prejudice. Such a "historian" often produced great tomes of unbiased social and natural description, but in

fact little headway was effected in advancing science precisely because no theoretical biases were utilized to focus the investigation. It is the intent of the following section to provide such a focus using lateral blinds to prevent straying into interesting but peripheral fields of inquiry.

4.3.1 PROBLEM ORIENTATION AS A BIAS

Theoretical biases involved in the prehistoric problem orientation include biases in: (1) research goals, (2) research procedures, and (3) assumptions about the nature of archeological cultures. In general, large blocksite surveys lend themselves most effectively to the study of prehistoric settlement patterns (Willey 1953). For this reason, the prehistoric problem orientation in the John Martin investigations will focus on an examination of settlement variability in time and space.

4.3.1.1 RESEARCH GOALS AS BIASES

Historians of the discipline of American archeology often periodize the growth of the field in terms of a sequence of: (1) data description by travelers and explorers, (2) archeology as culture history, (3) archeology as paleo-ethnography (behavioral or functional lifeway studies), and (4) archeology as processual explanation (Longacre 1970; Willey and Sabloff 1974). The first problem domain, data description, is long past. It faltered with the demise of nineteenth century antiquarians, incipient scientists who labored within the mode of the "natural historian." With the introduction of chronological studies such as stratigraphy and seriation in the early twentieth century, the archeologist as culture historian entered the second problem domain. The third research domain was inaugurated in the 1930s and 1940s by men, such as Steward (Steward and Setzler 1938 and Taylor 1948), who felt that individual societies and communities of the past should be analyzed in terms of their structure (i.e. organization) and function (i.e. operation) within a systems framework. As a parallel development, evolutionary studies showed a resurgence during this era under the inspiration of Childe (1951), Steward (1955), and White (1949). And finally, the fourth research domain, the explanation of social phenomena, is largely an outgrowth of the thinking of Binford (1968). An explanation, to Binford, is a statement which traces the processes by which some social form has come about. Processual statements explain how and why past behavior and cultural systems have evolved. To Binford, explanation is effected when observations on past behavior can be subsumed under general propositional statements called covering laws. This hypothetico-deductive strategy for research uses the Method of Hypothesis Testing as a procedure for organizing field and laboratory analysis (Binford 1968). It will be the bias of this study to undertake functional lifeway and evolutionary studies utilizing a deductive research design to effect processual explanation.

4.3.1.2 RESEARCH PROCEDURES AS A BIAS

These goals will be met using the Method of Hypothesis Testing as organized in terms of cultural propositions, hypotheses, test implications, and test statistics with region of acceptance or rejection specified (Hill 1970). This deductive design is one advocated by Braithwaite (1968) in which more general propositions are progressively rewritten in the form of numbered hypotheses and tests so that specific provisional statements will articulate with archeological reality.

4.3.1.3 ANALYTICAL BIASES

Two kinds of analysis are performed in the John Martin research: (1) formal analysis, and (2) distributional analysis. Because the survey was a modified, no pick-up operation, analysis of artifact form for the bulk of the specimens left in the field was conducted utilizing existing

typologies and taxonomies. See Figure 4.2 for a list of projectile-point and ceramic types which have already been established for southeastern Colorado and nearby surrounding regions. Other industries of stone, bone, shell, and perishable artifacts were classified according to the typologies of Campbell (1969a) since his Chaquaqua Plateau study is the most complete and closest to the John Martin research district. However, for those time-sensitive artifacts which were picked up in the field, primary laboratory description and identification was performed as part of the contractual obligations with the COE (see Section 5.3). The contractor feels that this dual set of collection rules has caused a minimal impact from research on the John Martin sites as well as minimizing the curatorial burden placed on the University of Denver, Department of Anthropology Museum.

The second kind of analysis, distributional study, will be performed to capitalize on the research potential of a large block survey in which both intrasite and intersite relationships can be examined for structural conclusions. Such distributional analysis is critical in order to understand the organization of past communities and societies and their settlement networking over the landscape. They are, in short, the very bases of functional lifeway reconstructions.

Intrasite distributions were studied by mapping the scatter of artifact forms found on each site. Such distributional analysis was conducted by point location; that is piece plotting each individual artifact specimen after it had been marked with an Engineer Pin Flag. Analysis of this quantitative data was conducted by such locational statistics as Nearest-Neighbor analysis and searching for internal clusters of tools and flaking debris (debitage) indicative of localized task-activities.

Intersite distributions were examined by locating sites and isolated artifacts on district-wide maps. Such plots allowed sites of different functional types to be analyzed in terms of networks of functional relationships which reflect both forms of land-use and human organization.

4.3.2 ASSUMPTIONS, HYPOTHESES AND TEST IMPLICATIONS

Two propositions are employed - one functional and one evolutionary. These are summaries of the respective assumptions, as these subjects can be related most directly to the archeological record. In turn, each proposition is rewritten as a series of quite precise hypotheses or provisional explanations. Each hypothesis is couched in the "if ..., then ..." format in which the preceeding "if" part sets the conditions for the subsequent prediction appearing as the "then" part of the explanation. The "then" prediction sets the test implications such that if the indicative facts are present in the data base, then the hypothesis must be accepted. Conversely, if the test implications are not met, then the hypothesis must be rejected. In the present study, the tests involve numerical variables such that statistical measurements are appropriate. In this study, probability values of 0.5 or less will be interpreted as less than chance events and therefore significant correlations.

Functional and evolutionary assumptions are employed in this study. Both are highly abstract statements taken from general anthropological theory. In this study, they will serve as givens upon which the propositions and hypotheses will rest. The assumptions are listed by number, but they are not individually tied to specific hypotheses or test implications.

Functional assumptions:

A_1 Critical to understanding the structure and function of ancient societies is interpreting the decisionmaking process involved in performing task-activities

which promoted human survival and well being.

A_2 The behavior involved in human task-activities, among other things, has to do with promoting survival through the acquisition, manufacture, distribution, and consumption of raw materials and energy. Examples of raw materials are stone, wood, fibers, clay, bone-antler, hides, and shell employed in manufacturing clothing, shelter, utensils, and ornaments. Examples of energy consumed are fuels (wood) and foodstuffs.

A_3 Furthermore, the behavior involved in other human task-activities concerns promoting the survival of a society surrounded by competitive and possibly hostile neighbors.

A_4 The behavior involved in task-activities is best promoted by organized human groups who are scheduled in seasonal time and spatially segregated in their work assignments to produce differing kinds of functional site types.

A_5. Seasonal scheduling and spatial segregation of human behavior is dictated by the animal and plant behavior of the most productive and staple crops, for example, bison migrations, seasons of fruiting by edible plants, and harvest times of cultigens such as corn.

A_6 Human behavior, in the form of task-activities, can be recognized in the archeological record through two kinds of analysis: (1) formal analysis of artifact attributes, artifact types, and site aggregates of artifact types as well as by (2) spatial-distributional analysis of attributes, types, and sites.

A_7 Critical to explaining the synchronic structure and function of the archeological record is the study of the formal and distributional variability of artifacts and sites.

A_8 Settlement sedentism is a reflection of food production involving a staple crop which can be preserved and stored for year-round use during seasons of non-production.

Evolutionary Assumptions:

A_1 Societies adapt to their surrounding natural and social (neighboring) environments by means of two kinds of behavior: (1) technoeconomic and (2) institutionalized forms of human organization.

A_2 Adaptation is the principal mechanism by which societies and cultures evolve through time.

A_3 Societies are goal-seeking entities which maximize their security and survival chances in the face of an uncertain world, challenged by the vagaries of the natural environment and the competitive avarice of hostile neighbors.

A_4 Critical natural challenges requiring adaptive adjustments are oscillations in the climate of both an adverse nature (drought, flood, hail, lightning, changes in migration routes, floodplain erosion) and a beneficial nature (ample rainfall for floodwater farming and short-grass prairie productivity; floodplain aggradation promoting corn agriculture).

A_5 Critical social challenges requiring adaptive adjustments are the introduction of new ideas (diffusion, acculturation) and/or raiding of enemy neighbors.

A_6 Periods of high stabilility or little cultural change are caused by successful forms of adaptation which maximize productivity in terms of materials, energy, and human population which at the same time minimize the necessity for work input.

A_7 Critical to explaining the diachronic regularities of the archeological record is the study of artifact and site formal and distributional variability.

A_8 Historical explanations, such as diffusion, acculturation, migration, invention, and innovation, are valid change processes if they are accepted as communication input to local problems of adaptation.

A_9 Societies change in an evolutionary and functional sense only when forced to do so; the normal process is nonchange or social stability in a stable environmental context.

4.3.2.1 FUNCTIONAL PROPOSITION AND DERIVATIVE HYPOTHESES (H_n)

PROPOSITION 1: Human activities are differentially arranged on the landscape according to the resources sought and the nature of human social arrangements to define a distinctive pattern of adaptation.

$H_{1.0}$ Site activities and artifact arrangements show a random or uniform distribution on the landscape.

$H_{1.1}$ If site activities are determinative of location, then resource-procurement (special activity) sites should exhibit close proximity to specific seasonal natural resources (i.e., vegetation and game).

$H_{1.2}$ If site activities are determinative of location, then tool manufacture, maintenance, and repair activities at base camps or villages should exhibit compromise proximity to a variety of resources (food, water, lithics, topographic setting) necessary for large group support. Ecotone setting and number of ecotones present in a 1-km catchment basin should be high.

$H_{1.3}$ If site activities are determinative of location, then social arrangements should be exhibited by networked clusters of nearby complementary sites to effect a particular pattern of community organization.

$H_{1.4}$ If intrasite activities are determinative of location, then artifact distributions within the sites should be nonrandomly arranged (i.e., clustered) to express a distinctive pattern of task-activities.

$H_{1.5}$ If site activities are determinative of location, then certain staple sources of food (bison hunting or floodwater horticulture) are overridingly important in site location and organization of human society (size of group, kinship type, economic type, mobility patterning, and settlement type).

$H_{1.6}$ If site activities are determinative of location, then sets of environmental (i.e., resource) variables are predictive of site location, site number and site function.

4.3.2.2 FUNCTIONAL TEST IMPLICATIONS

$T_{1.0}$ NEAREST NEIGHBOR statistic for site and artifact distributions is either random (R_n=1.0) or uniform (R_n=2.15) control: time, type). CHI-SQUARE association statistic between

discrete environmental variables and site-type counts shows no difference (p greater than 0.05). PEARSON R statistic shows low values (0.0) between environmental and site-artifactual variables. Numerical Taxonomic System (NTSYS) analysis for artifact and site variables shows little difference between and among taxa.

$T_{1.1}$ NEAREST NEIGHBOR statistic between special-activity and base-camp distribution is clustered (R_n=0.0). CHI-SQUARE statistic for special-activity site counts and discrete environmental variables is significant at less than the 0.05 level of probability. PEARSON R between procurement resources and special-activity site attributes are high (R=1 .0). SPEARMAN AND KENDALL RANK-ORDER CORRELATION COEFFICIENTS between special-activity site attributes and faunal occurrence will be high R=1.0). NTSYS will allow classification of sites based on artifact attributes and types which will show high discrimination of sites of differing functional task-activity sets, such as special-activity sites, base camps and villages.

$T_{1.2}$ PEARSON R statistic between particular environmental resources and camp-settled village attributes will be low, reflecting a compromise strategy in which the site type is located halfway between and among the most critical set of environmental determinants.

$T_{1.3}$ NEAREST NEIGHBOR statistic should show high clustering (R_n=0.0) among sets of same-age sites of complementary functional type.

$T_{1.4}$ NEAREST NEIGHBOR statistic for within-site artifact distributions will be clustered (R_n=0.0). NTSYS analysis will show high discrimination among intrasite artifact clusters.

$T_{1.5}$ See tests, predictions, and regions of acceptance or rejection for Hypotheses 1.1 and 1.2.

$T_{1.6}$ Site location location and density will be predicted by environmental variables using REGRESSION ANALYSIS.

4.3.2.3 EVOLUNTIONARY PROPOSITION AND DERIVATIVE HYPOTHESES (H_n)

PROPOSITION 2: Both environmental and social patterns of adaptation are causal in the evolution of new cultural types (Paleo-Indian, Archaic, and Formative).

$H_{2.0}$ Cultural change in the form of growth and development in the artifact assemblage of sites is not exhibited in the archeological record.

$H_{2.1}$ If changes in the natural environment (Wisconsin stadials; Boreal, Atlantic, post-Atlantic climates) take place, then local cultures will adjust through changes in economic procurement (food collection, food production), production, and distribution of goods and services.

$H_{2.2}$ If favorable changes in the natural environment (floodplain aggradation for farming, increased rainfall, and bison forage) take place, then local cultures will adjust through growth in human population.

$H_{2.3}$ If unfavorable changes in the natural environment (drought, reduction in the

grazing potential, megafauna extinction, floodplain degradation, wind deflation) take place, then local cultures will adjust through population decline and *emigration from the district.*

$H_{2.4}$ If changes in the natural environment take place, then local cultures will adjust through changes in settlement networking and arrangement on the landscape.

$H_{2.5}$ If favorable changes in the natural environment take place, then local cultures will adjust through growth and development along the evolutionary track of Paleo-Indian, Archaic, and Formative.

$H_{2.6}$ If stability within climatic periods is experienced in the natural environment, then persistence should be exhibited in the archeological record.

$H_{2.7}$ If changes occur in the surrounding social environment (trade, diffusion, warfare in the form of raids, acculturative contact), then local cultures will adjust by incorporating new ideas, new defensive postures, and/or emigrating from the district.

$H_{2.8}$ If new stimulations are not introduced by neighboring peoples, then local cultures will exhibit persistence in the archeological record.

4.3.2.4 EVOLUTIONARY TEST IMPLICATIONS

$T_{2.0}$ CHI-SQUARE association statistic between artifact types and developmental stages (Paleo-Indian; Early, Middle and Late Archaic; Woodland; Panhandle Aspect; and Proto-historic nomadic Indians) will show no difference ($p > 0.05$).

$T_{2.1}$ CHI-SQUARE association statistic *between climatic periods and economic* procurement indicators (projectile points for hunting and milling tools for plant processing) will show a high value ($p < 0.05$).

$T_{2.2}$-$T_{2.3}$ One sample CHI-SQUARE test between favorable and unfavorable environmental changes and human population estimates (measured by component count) will show significant associations ($p < 0.05$).

$T_{2.4}$-$T_{2.8}$ Use similarity matrix and dendrogram of artifact frequencies by phase to test for within-tradition stability. Sites from genetically related phases comprising a tradition will show similar clustering at high phenon level (Johnson 1968). Sites of different adaptive and historical traditions will show cluster joining on dendrogram at low phenon level.

4.3.2.5 SUMMARY

In this section we have outlined the specifics of the deductive research strategy. This has been accomplished in terms of particular functional and evolutionary assumptions, propositions, hypotheses, and test implications. Figure 4.5 lists these elements of the research design in summary form.

In order to evaluate these hypotheses, it will be necessary to confront the problem of chronology (see Section 5.4). If it is not possible to date the bulk of the sites, then the effectiveness of the functional analysis is much reduced. By the same token, evolutionary studies absolutely require time control on the data. Other require-

FIGURE 4.5 CHART LISTING ELEMENTS OF THE RESEARCH DESIGN

Numbered Hypotheses	Test Implications	Variables Employed	Test Statistics	Test results and/or Probability
$H_{1.0}$ Random or uniform distribution	$T_{1.0}$	VAR4,5 VAR29,30	R_n	R_n=1.0,2.15
		VAR7,8,21-28,32	Chi-square	P>0.05
		VAR9-20, 31,33-37 38-60	Pearson R.	R=0.0 P>0.05
		VAR1-7 29-60	NTSYS	Little difference between and among taxa.
$H_{1.1}$ Special activity sites	$T_{1.1}$	VAR32	R_n	R_n<1.0
		VAR32,8, 21-28,17-19	Chi-square	P=<0.05
		VAR13-17,20 31-37	Pearson R	R= - 1.0
		VAR33-37 21-28	Spearman Rank Corr. Coef.	R = 1.0
		VAR31-33-60	NTSYS	Taxa discriminated
$H_{1.2}$ Base Camp or villages	$T_{1.2}$	VAR31,33-37	Pearson R	R = 0.0
		17-18,20		R = -1.0
		19-		R = +1.0
$H_{1.3}$ Complementary site types	$T_{1.3}$	VAR32,29-30	R_n	R_n= <1.0
$H_{1.4}$ Task-activities	$T_{1.4}$	VAR1-5	R_n	R_n=<1.0
		VAR38-60	NTSYS	Taxa discriminated

FIGURE 4.5 - CONTINUED

Numbered Hypotheses	Test Implications	Variables Employed	Test Statistics	Test results and/or Probability
$H_{1.5}$ Staple foods	$T_{1.5}$	See Hypotheses 1.1 and 1.2		
$H_{1.6}$ Site Predictions	$T_{1.6}$	VAR9-20,	Pearson R	R = +1.0
$H_{2.0}$ No difference	$T_{2.0}$	VAR2	Chi-square	$P \leqslant 0.05$
$H_{2.1}$ Procurement indicators	$T_{2.1}$	VAR2	Chi-square	$P \leqslant 0.05$
$H_{2.2}$- $H_{2.3}$ Population	$T_{2.2}$ - $T_{2.3}$	Age	Chi-Square	$P \leqslant 0.05$
$H_{2.4}$- $H_{2.8}$ Traditions of clustered sites	$T_{2.4}$- $T_{2.8}$	VAR38-60	NTSYS	Taxa discrimination

ments for hypotheses evaluation are investigations into site assemblage content and structure, subjects which are addressed in Section 6.0.

4.3.3 DATA VARIABLES AND ANALYTICAL METHODS NECESSARY TO TEST HYPOTHESES

The purpose of the following section is to specify which artifactual and site variables have been selected for computer analysis. Defining criteria and coding format are also given for each of the cultural variables. Earlier, similar information was provided for the critical environmental variables (Section 3.4). Selection of the 59 environmental and cultural variables employed to measure settlement variability was drawn from the test implications of each hypothesis (Section 4.3.2). The statistical procedures whereby each of these variables is manipulated are also presented. These include univariate, bivariate, and multivariate analyses.

4.3.3.1 ARTIFACT VARIABLES AND THEIR CODING

The artifactual variables are listed on Figure 4.6 as Variables 1 through 7. The first seven data records appear on center punch Card 1 where they form the basis for the intrasite analysis.

DEBITAGE CODE (VAR1)

The French term "debitage" is employed in lithic studies to refer to all kinds of discarded waste resulting from the manufacture of stone tools. Basically these are flakes and cores. The latter are the percussion removals from cores or parent nodules or blocks. Finished tools may be made either from the flake removals or sculptured out of the core itself. Debitage Variable 1 was coded in seven nominal values as follows:

Primary Flake (Code 01)

First generation removal from a core in which the dorsal surface of the flake is completely covered with cortex. Lacks any evidence of utilization and rarely will a prepared platform be present; sometimes called a cortex flake.

Secondary Flake (Code 02)

Second generation removal from a core in which the dorsal surface of the flake shows some cortex as well as some negative flake scars. Lacks any evidence of utilization.

Tertiary Flake (Code 03)

A third-generation flake removed from a core in which the dorsal surface of the flake shows no cortex being completely covered with negative flake scars. No evidence of utilization; sometimes referred to as an interior flake.

Unclassified Flake (Code 04)

In some cases, the specimen was recorded in the field as a flake but not otherwise differentiated. The flake may have been badly rolled by water action or wind blasted thereby obscuring its flake attributes. Or the specimen has been broken and the observed fragment can not be accurately identified as to debitage type.

Biface Thinning Flake (Code 05)

An interior flake which has been removed from a biface in the manufacturing process of shaping and thinning. Distinctive attributes will be a lipping on the interior margin of the platform, dihedral-shaped platform resulting from the removal of the biface edge, and acute angle obtaining between the platform and the ventral surface of the flake.

FIGURE 4.6 LIST OF VARIABLES FOR STUDYING PREHISTORIC FUNCTIONAL AND EVOLUTIONARY CHANGE

Card 1-Artifactual Variables

COLUMN	VARIABLE NUMBER (VAR NO.)	ENTRY	LEVEL OF MEASUREMENT
1-5		Site No.	n.a.
6		Blank	
7-9		Artifact No.	n.a.
10		Blank	
11		Card No.	n.a.
12		Blank	
13-14	VAR1	Debitage	Nominal
15		Blank	
16-17	VAR2	Tool Type	Nominal
18		Blank	
19-20	VAR3	Material	Nominal
21		Blank	
22-25	VAR4	Angle (Degrees azimuth)	Interval
26		Blank	
27-30	VAR5	Distance (m from Datum)	Interval
31		Blank	
32-33	VAR6	Feature Code	Nominal
34		Blank	
35-37	VAR7	N (Total No. of Artifacts)	Interval
38		Blank	
39-41		Print (Output Option)	n.a.
42		Blank	
43-52		Area (Site area in m)	Interval
53		Blank	
54		IFLAG (Output Option)	n.a.
55		Blank	
56		JFLAG (Output Option)	n.a.

Card 2-Environmental Variables

1-5		Site No.	n.a.
6		Blank	
7-9	VAR8	Range site type	Nominal
10		Blank	
11		Card No.	n.a.
12		Blank	
13-15	VAR9	On-site Slope (% Grade)	Interval
16		Blank	
17-19	VAR10	Surrounding Slope (% Grade)	Interval
20		Blank	
21-24	VAR11	Aspect (Degrees)	Interval
25		Blank	
26-30	VAR12	Site Elevation (m)	Interval
31		Blank	
32-36	VAR13	Distance to Nearest Intermittent Drainage (m)	Interval
37		Blank	

FIGURE 4.6 (CONTINUED)

38-41	VAR14	Height Above Intermittent Drainage (m)	Interval
42		Blank	
43-47	VAR15	Distance to Arkansas (m)	Interval
48		Blank	
49-53	VAR16	Height above Arkansas (m)	Interval
54		Blank	
55-59	VAR17	Distance to Edge of Range Site (m)	Interval
60		Blank	
61-63	VAR18	% of Dominant Range Site in 1 Km. Circle	Interval
64		Blank	
65	VAR19	No. of Different Range Sites/1 Km. Circle	Interval
66		Blank	
67-70	VAR20	Medium Standing Crop Yield (lbs/acre)	Interval
71		Blank	
72	VAR21	Bison	Ordinal
73	VAR22	Antelope	Ordinal
74	VAR23	Deer	Ordinal
75	VAR24	Jack Rabbits	Ordinal
76	VAR25	Cotton Tail Rabbits	Ordinal
77	VAR26	Elk	Ordinal
78	VAR27	Upland Game Birds	Ordinal
79	VAR28	Waterfowl	Ordinal
Card 3-Site Variables			
1-5		Site No.	n.a.
6-10		Blank	
11		Card No.	n.a.
12		Blank	
13-18	VAR29	UTM East	Interval
19		Blank	
20-25	VAR30	UTM North	Interval
26		Blank	
27-28	VAR31	No. of Hearths	Interval
29		Blank	
30-31	VAR32	Site Type	Nominal
32		Blank	
33-38	VAR33	Site Size (Area, m^2)	Interval
39		Blank	
40-42	VAR34	No. Artifact Types	Interval
43		Blank	
44-50	VAR35	Artifact Density (No./m^2)	Interval
51		Blank	
52-55	VAR36	Site Density/1 km. circle dia.	Interval
56		Blank	
57-60	VAR37	Site Density/3 km. circle	Interval
61		Blank	
62-64	VAR38	Chopper (% Freq.)	Interval
65		Blank	
66-68	VAR39	Hammer (% Freq.)	Interval

FIGURE 4.6 (CONTINUED)

69		Blank	
70-72	VAR40	Scraper (% Freq.)	Interval
73		Blank	
74-76	VAR41	Biface (% Freq.)	Interval
77		Blank	
78-80	VAR42	Proj. Points (% Freq.)	Interval
	VAR43	Skipped	

Card 4-On-Site Artifact Variables

1-5		Site No.	n.a.
6-10		Blank	
11		Card No.	n.a.
12		Blank	
13-15	VAR44	Graveler (% Freq.)	Interval
16		Blank	
17-19	VAR45	Utilized Flake (% Freq.)	Interval
20		Blank	
21-23	VAR46	Flake Knife (% Freq.)	Interval
24		Blank	
25-27	VAR47	Metate (% Freq.)	Interval
28		Blank	
29-31	VAR48	Mano (% Freq.)	Interval
32		Blank	
33-35	VAR49	Cores (% Freq.)	Interval
36		Blank	
37-39	VAR50	Primary Flakes (%Freq.)	Interval
40		Blank	
41-43	VAR51	Secondary Flakes (% Freq.)	Interval
44		Blank	
45-47	VAR52	Tertiary Flakes (% Freq.)	Interval
48		Blank	
49-51	VAR53	Biface Thinning Flake (% Freq.)	Interval
52		Blank	
53-55	VAR54	Rejuvination Flakes (% Freq.)	Interval
56		Blank	
57-59	VAR55	Unclassified Flakes (% Freq.)	Interval
60		Blank	
61-63	VAR56	Misc. Core Tools (% Freq.)	Interval
64		Blank	
65-67	VAR57	Biface Knife (% Freq.)	Interval
68		Blank	
69-71	VAR58	Unclassifiable Ground Stone Tools (% Freq.)	Interval
72		Blank	
73-75	VAR59	Manuport (% Freq.)	Interval
76		Blank	
77-79	VAR60	Potsherds (% Freq.)	Interval

Rejuvenation Flake (Code 06)

An interior flake removed from a cutting, chopping, or hammering edge in the process of resharpening that tool. The dihedral flake platform will exhibit evidence of the dulled wear from the tool-use edge.

Core (Code 07)

A block of parent material from which flakes have been removed for subsequent uses. Cores may be blocky chunks of rock obtained by quarrying from a suitable cryptocrystalline outcrop, or they may be rounded and cortex-weathered stream cobbles collected from modern river channels or geological terraces. In the process of use as a core, the parent material may be prepared with a platform or unprepared with flakes removed by direct percussion on the unmodified cortex surface or struck using previous flake scars as a working platform. Cores may, themselves, be further used as tools such as choppers, hammers, scrapers, or miscellaneous core tools.

TOOL-TYPE CODE (VAR2)

The tool typology for lithic implements is one commonly used in eastern Colorado. Although the type names are functional in nature, the precise use of any particular specimen is uncertain without microscopic examination of edge wear; a procedure which could not be performed in the field given the limitations of a modified, no-pickup survey. The tool typology of *Variable* 2 is divided into four nominal categories: core tools, flake tools, ground-stone tools and ceramics (Figure 4.7). Core tools, such as choppers, hammers, and scrapers, are made on large chunks or nodules of stone. Flake tools are usually smaller, finished implements manufactured on flakes which often display attributes of percussion manufacture on the ventral surface such as point of impact, radial fissures, compression rings, bulb of percussion, and the bulbar scar. Examples of flake tools are bifaces, projectile points, gravers, scrapers, utilized flakes, choppers, and biface knives. Milling implements, such as metates and manos made on sandstone slabs, are classified as ground-stone tools. Finally, potsherds are broken fragments of ceramic vessels. These artifacts of Woodland and later age are usually cord-marked in the process of manufacture.

The ceramics and projectile points are stylistically time sensitive and thus useful for dating purposes. These were picked up in the field and given special attention in our laboratory study as reported in Section 5.3. All other shaped tool classes were field recorded and left undisturbed on the site.

Chopper (Code 01)

A core tool with bifacial or unifacial cutting edge formed by the intersection of negative flake scars, or, if unifacial, the flake scars and the cortex surface of the core. The resulting V-shaped or check-shaped cutting edge will exhibit chopping use in the form of step fractures; a form of dulled wear resulting from chopping soft, pliable material such as wood, fiber, bone, ligament, or meat. Core tools lacking such wear are not identified as choppers but rather coded in the core category (VAR1, 07).

Hammer (Code 02)

A hammer is a core tool of two kinds. Sometimes small cobbles or chunky blocks of material were used as hammers without preparation. Distinctive wear attributes are pitting and crushing resulting from hammering in stone tool manufacture and tool maintenance. A second kind of hammer results from cores which are subsequently put to use as hammers. These are identifiable by hammer-use crushing and pitting along the aries or flake-scar intersections.

Scraper (Code 03)

A unifacial edge tool made on a core is called a scraper. The working edge is prepared by intentional retouch and may show signs of use in the form of edge shearing. This heavy-duty tool may have been used for woodworking and/or the preparation of hides by scraping.

Miscellaneous Core Tool (Code 04)

The specimen was field recorded as a core tool but the nature of the tool category could not be determined from the notes or was not determinable in the field.

Biface (Code 10)

A tool manufacturing stage which is biconvex in cross section and oval, round, or elongate in outline. Many such implements are leaf-shaped. They are manufactured by stone of billet blows struck along the perimeter thereby shaping and thinning the piece. In the process, the biface edges may be ground with a sandstone abrader in order to strengthen them for the next generation of thinning flake removals (VAR1, Code 05). Bifaces may be manufactured from cores in which case early manufacturing stage pieces will exhibit cortex, whereas those made from large flakes will or may show flake attributes. The end product of bifaces will be hafted biface knives (asymetrical in shape and sometimes notched or stemmed), projectile points, and/or drills.

Projectile Point (Code 11)

A projectile point is a finished biface appearing as a lanceolate spear tip, primary-stemmed dart point, or notched dart or arrow point. If the piece has been field collected for laboratory analysis, microscopic examination under high magnification may show rotary wear on the point tip indicative of secondary use as a reamer or rotating drill. Other wear possibilities are edge crushing and rounding, as a result of dulling through use as a knife. Several such uses may be evidenced on the same specimen. Projectile tips recovered as isolated finds often have impact scars from hitting game quarry or ground hits.

Graver (Code 12)

A graver is a flake (rarely core) tool which has been notched in such a way as to produce a point formed by the convergence of two edges. The use point may be sharp or chisel-shaped. In either case, the implication is of a tool used to engrave or slot wood, bone, antler, and/or shell. Other proposed uses are as a separater of Yucca leaf fibers for manufacture of cordage or the cutting of hides and skins. In any case, microscopic examination of the dulled scoring point should reveal rounding and removal of a shearing flake from the upper spine of the working point.

Scraper (Code 13)

A unifacial tool intentionally manufactured by retouch pressure chipping along the edge of a flake. Usually the chipping tool is used to shear from the ventral surface of the flake, removing chips from the dorsal surface. Such intentional manufacture may create an edge predominantly along the lateral margin of a flake to produce a side scraper, or the removals are taken from the distal end of the flake to produce an end scraper. Other possibilities are complete pressure chipping to form a perimeter scraper, or the manufacture may form an indented, concave edge as in a spokeshape. Due to the lack of laboratory examination in our no-pick up recording strategy, all scrapers are recorded as a single field observation. To actually demonstrate that these unifacial tools are scrapers, it would be necessary to microscopically examine each specimen looking for use shearing and dulling as in the processing of wood, fibers, or hides. Further, evidence of refurbishing scrapers can be detected by edge retouch (VAR1,

Code 06).

Utilized Flake (Code 14)

Flake debitage which has opportunistically been used for scraping and/or cutting is called a utilized flake. Such expediency tools will not show any evidence of intentional edge retouch as in manufacture shaping but rather will display the irregular, haphazard edge shearing from use as flake scrapers (unifacial) or flake knives (bifacial shearing).

FIGURE 4.7 LIST OF TOOL TYPES AND THEIR CODING FOR VARIABLE 2

Core tools:
- Chopper = 01
- Hammer = 02
- Scraper = 03
- Miscellaneous Core Tool = 4

Flake tools:
- Biface = 10
- Projectile Point = 11
- Graver = 12
- Scraper = 13
- Utilized Flake = 14
- Flake Knife = 15
- Flake Chopper = 16
- Biface Knife = 17

Ground Stone Tools:
- Metate = 30
- Mano = 31
- Unclassified Milling Stone = 32
- Manuport = 33

Ceramics:
- Potsherd = 34

Flake Knife (Code 15)

A large flake with one or more edges bifacially retouched (intentional shearing with pressure tool) to a cutting edge. However, the piece lacks all-over biface thinning as in the case of bifaces so that the bi-convex section and perimeter shaping are absent. Microscopic use-edge examination should reveal dulling wear in the form of crushing, rounding, and polishing as in cutting wood, fiber, bone, hides, or meat. The lack of stem notching suggests that the implement was hand held rather than hafted as in the case of a biface knife.

Flake Chopper (Code 16)

A flake chopper is the same as a core chopper, however, it is made on a large flake.

Biface Knife (Code 17)

A biface knife is the same as biface, however, the piece has been finished by edge retouch. Microscopic examination should show knife-use in the dulling expressed as crushing, rounding, and possibly polishing. The piece may or may not have been hafted but lack of pitch or remaining handle will make this interpretation difficult to ascertain. However, the distribution of the edge-wear may throw some light on this interpretive problem. The piece may be notched for hafting.

Metate (Code 30)

A metate is a milling tool with evidence of having been ground on by a hand-held mano tool (see VAR2, Code 31). A metate is made on a fine-grained sandstone with naturally abrasive characteristics. The metate block is a slab which has been quarried from the local Dakota sandstone (Sharps 1976). Once quarried out as a slab, the block was shaped by percussion flaking. Next the oval-shaped milling basin was roughed out by hammer pitting. Use subsequently smoothed and deepened the grinding area which was periodically resharpened by hammer roughening. Ground

wear on the metate milling areas does not clearly indicate any preference between rotary and reciprocal use of the mano (Eddy 1964). Most metate finds are broken pieces of which many display bifacial milling use. Often the metate fragments are oxidized by fire as though secondarily used as hearthstones. Some piles of metates have been called caches in the John Martin survey.

Although not exclusively confined to the southern edge of the reservoir, certainly the highest frequency of milling tools comes from sites on stabilized dune fields. Presumably milling of large seeded grasses, which today favor the dunes, accounts for the common occurrence of metates on sites along the southern edge of the Arkansas River.

Mano (Code 31)

One-hand milling tools were used as the superior grinder with the companion metate implement (see Code 30). Manos are oval to subrectangular in shape with a thick, biconvex section. Worn manos will often show grinding facets resulting from extra hand pressure being applied on the trailing edge of the milling stroke. Many manos are bifacial in their grinding faces. Although these specimens may have been used throughout the Archaic and post-Archaic periods, the very high frequency of implements on some sites is likely a temporal indicator of Archaic occupation, when collection and milling of wild grass seeds was most prevalent.

Miscellaneous Milling Stone (Code 32)

Field recording does not specify whether these pieces are metates or manos. This oversight most probably was due to the small milling-stone fragments, broken in use and further reduced in size by heat fracturing as the sandstone rocks were secondarily utilized as hearthstones.

Manuports (Code 33)

A rock which has been recorded in site mapping but in fact displays no attributes of either manufacture or use is called a manuport. Identification of the piece as an artifact is based entirely on the site context; human rather than natural agencies being the only reasonable means of introducing the foreign rock material onto the site. In the John Martin survey, Manuports were identified almost exclusively on sand dune sites (Range Sites 19 and 22) where aeolin action would have been insufficient cause to explain the presence of the stone. The term "manuport" was coined by Mary Leakey (1971) for unmodified stones found on East African sites of early Pleistocene age. Manuports are often called "dog stones" in the archeological vernacular, implying a stone chucked at a dog, wild game, or some unfriendly neighbor.

Potsherd (Code 34)

Code 34 is a count of pieces of broken, fired clay pots. All examples are plain or cord-marked and no examples of Sopris or Upper Rio Grande trade pottery have been identified from the reservoir area.

MATERIAL CODE (VAR3)

Stone artifacts were recorded as to material on Card 1. Seventeen different kinds of rock were used in manufacture. These included igneous (basalt, granite, andesite, and rhyolite), metamorphic (quartzite), and Sedimentary (chert, jasper, chalcedony, quartz, petrified wood, obsidian, siltstone, agate, sandstone, and shale) as listed on Figure 4.8. All of these materials are to be found naturally in the Pleistocene terraces appearing along the north flank of the Arkansas River valley where they were conveniently at hand for the prehistoric knapper. Further, many of the cores, flakes, and finished tools are made on rocks still showing the natural cortex

rind of water-tumbled pebbles, indicating that they had been gathered from the local terrace deposits rather than quarried from a nonlocal source in the mountainous headwaters of the river drainage basin. Two other materials, alibates chert and obsidian, are foreign in origin and therefore were introduced by means of prehistoric trade. The mottled pink and white alibates chert is known to occur along the Canadian River in Texas and Oklahoma. According to Campbell (1969a) the presence of dark gray, glassey obsidian in southeastern Colorado is evidence of prehistoric trade with the upper Rio Grande Pueblos of the Taos area.

FIGURE 4.8 LIST OF STONE ARTIFACT MATERIALS AND THEIR CODING FOR VARIABLE 3

Unknown = 00
Basalt = 01
Quartzite = 02
Chert = 03
Alibates Chert = 04
Jasper = 05
Chalcedony = 06
Quartz = 07
Petrified Wood = 08
Obsidian = 09
Glass = 10
Siltstone = 11
Agate = 12
Flint = 13
Granite = 14
Sandstone = 15
Shale = 16
Andesite = 17
Rhyolite = 18

ANGLE (VAR4) AND DISTANCE (VAR5)

In the process of scattergram-mapping artifacts making up any given prehistoric lithic scatter site, a Brunton compass with tripod was set up on an arbitrarily designated datum. Each artifact was measured in to the datum in terms of two provenience measures: angle and distance. The angle was measured by the Brunton pocket transit in terms of azimuth heading from true north. The distance from datum to artifact was taped in meters and tenths of meters to accurately fix the position of the specimen in two dimensional space. The provenience bearings were employed in constructing a scattergram map in the field and again as input for computer mapping in the laboratory. Further, the provenience measures of angle and distance were basic input data for the intrasite Nearest Neighbor analysis.

FEATURE CODE (VAR6)

Fixed facilities such as architectural constructions are coded as features. Such immobile constructions are nominal observations, such as hearths, rock cairns, stone walls, tipi rings, rock art, rock shelters, scattered hearthstones, and stone circles.

Hearth (Code 01)

Hearths were recognized in the field by piles of burned rock. The hearthstones, often granite, basalt, or sandstone, showed evidence of burning as reddish oxidized discoloration from heat and angular fracturing. Rarely was charcoal present or any oxidized discoloration of the underlying soil.

Rock Cairn (Code 02)

Cairns are piles of rock without evidence of burning. They may have been erected as boundary markers or for some unascertained reason.

Stone Walls (Code 03)

Dry-laid masonry attached to rock shelters

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CO F W EDDY ET AL. 31 AUG 82 DACW47-80-C-0002

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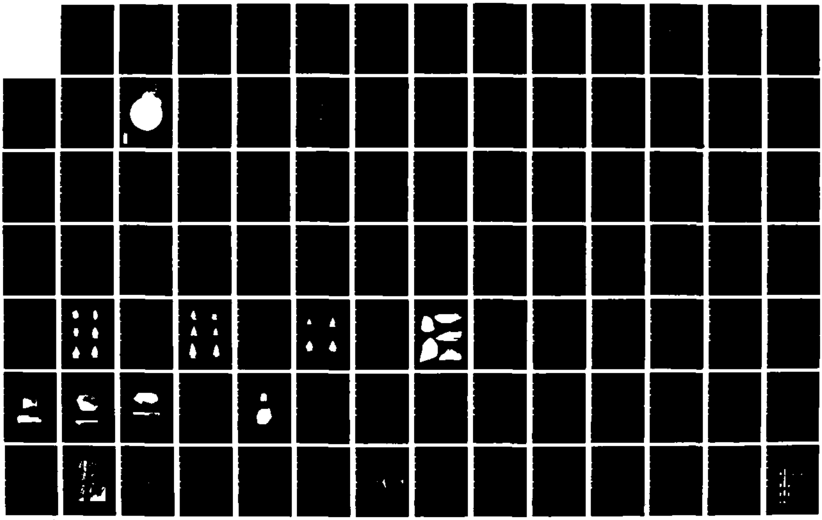
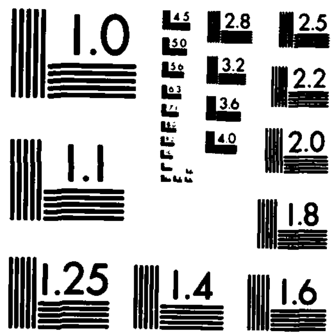




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

or cliffs were coded as stone walls. The rock is local unshaped sandstone without evidence of mortar. The age is not apparent. They could be prehistoric windbreaks or house walls, or they might be historic-age sheepherder corrals. Tested site JM124 is a stone wall enclosure of Formative age (Section 5.6).

Tipi Ring (Code 04)

A ring of stream cobbles one-stone high and one-wide is defined as a tipi ring. These constructions are likely alignments of stones used to weight the bottom of a historic tipi.

Rock Art (Code 05)

Pecked and incised rock art has long been known from the weathered face of sandstone outcrop cliffs flanking the Arkansas River. These outcrops, which often form the step riser to a Pleistocene terrace, are found all along the river but are particularly prominent in the lower reach of Rule Creek where rock art panels are most common. In the field, these were recorded by sketch and/or photography. See Section 5.5 for a description of the motifs and panels.

Rock Shelters (Code 06)

Shallow overhangs were occasionally found in the sandstone cliff faces along the Arkansas River and in the lower reach of Rule Creek. These sometimes had rock-art panels associated and otherwise gave evidence of having been used as campsites for the natural shelter they provided. Evidence of occupation consists of a smoke-blackened roof and a litter of artifacts found on the shelter floor. Rarely a dry-laid stone wall would be associated with the overhang. It is hypothesized that the south facing shelters were occupied during the winter when solar insulation would be most effective in warming the overhang and providing natural light. North facing shelters, which would be shaded during the winter, were likely favored for camping and storage during the summertime. See Section 5.6 for a description of a tested rock shelter, JM081.

Artifact Cluster (Code 07)

Piles of artifacts were infrequently observed on a site. In some instances, these were obviously due to postoccupational disturbance by collectors or other site visitors. In other incidences, piles of artifacts such as milling stones are thought to have been due to living activities of the original site inhabitants.

Scattered Hearthstones (Code 08)

Some sites showed evidence of scatters of burned rock without any signs of intact hearths. It is likely that these scattered hearthstones are from disturbed fire hearths; the disturbance may have taken place during the time of occupation, or it may have occurred subsequently.

Stone Circle (Code 09)

Rarely circles of stone were observed on sites, but the nature of these was not clear. They may have been indistinct remains of tipi rings or they could be partially obscured stone walls of a Formative-age farmhouse.

N OR TOTAL NUMBER OF ARTIFACTS RECORDED (VAR7)

The total number of artifacts is recorded as Variable 7. Where this figure is under 100, this will be the total for that site. However, for large sites over 100 specimens in size, the N recorded will only represent the recorded sample of mapped specimens. It is hypothesized that small artifact counts will be special-activity camps, whereas large artifact counts will be found on base camps and villages. Another hypothesis for large-artifact-count sites is that they are seasonal occupations which were revisited many times over

the years. Revisitation should be identifiable by finding a limited-artifact-type count (VAR34) suggestive of a specialized-activity camp used over and over again.

4.3.3.2 SITE VARIABLES AND THEIR CODING

Thirty-two site variables are listed in Figure 4.6. This includes Universal Transverse Mercator coordinates (UTMs), number of hearths, site type, site size, number of artifact types, artifact density, site density within a one and three kilometer circle, and 23 artifact-type frequency variables. These data form the basis for the intersite analysis.

UTM EASTING AND NORTHING (VAR29 AND 30)

The two UTM Grid System measurements provide an accurate set of point locational coordinates for each site. UTM grid measurements for the John Martin sites consist of a zone (13), an easting (metric measurement taken from the west line of the zone) and a northing (metric measurement north from the equator). The easting is a six-digit number, while the northing is a seven-digit figure. In this study, the UTM coordinates are employed as data for an intersite analysis using the Nearest Neighbor statistic in order to define significant site clusters reflecting former prehistoric communities.

NUMBER OF HEARTHS (VAR31)

A count of the number of hearths on a site is the data observation for VAR31. Hypothetically, base camps should display evidence of many more hearths than special-activity sites.

SITE TYPE (VAR32)

The nominal observation of site type was determined objectively through clustering of 22 tool and lithic debitage variables. Seven numbered site types were defined by NTSYS analysis of which five are special-activities sites and two are base camps. The functional purposes of each site type were determined by investigating which tool types contributed most significantly to each clustered type. Another line of argument for functional identification was obtained by cross-tabulating the site types with discrete environmental variables. See Section 6.1 for the list of site types and their interpretations.

SITE SIZE (VAR33)

Variable 33 is a measure of site size in terms of its area in square meters. This figure is computed as an estimate based on the length times the width of the site taken from the scattergram map; the measurements being made from the artifact distribution perimeter. Again, base camps should be bigger than special-activity sites given the same density of artifacts.

NUMBER OF ARTIFACT TYPES (VAR34)

A count of the different kinds of artifacts (combined tools and debitage) appearing on a site constitutes Variable 34. Such a measure reflects the information variety of a site; an index of the range of activity-tasks once conducted there. It is expected that base camps will exhibit a high count of artifact types, whereas special-activity sites will reveal a low count.

ARTIFACT DENSITY (VAR35)

The density of artifacts on a site should reflect the intensity of its former occupation. Density, or number of artifacts per square meter, is computed by dividing the artifact count (VAR7) by the site size (VAR33).

SITE DENSITY (VAR36 AND 37)

Two site densities are computed. One is a count of neighboring sites within a 1-km circle

(VAR36) and the second a count within a 3-km circle (VAR37) made within a template held over any particular site. Density was calculated by multiplying the number of sites times the area of a circle using 0.5 and 1.5 respectively for the 1-km and 3-km circle radiuses, according to the following formula:

$$n(4/3\,\pi r^2)$$

Site density will allow measurement of packing. Site cluster communities should express high density packing while isolated sites and artifact finds will express low density of land use between and among prehistoric communities. Site density is also a reflection of resource carrying capacity which should increase through time as a function of food production and sedentism. In Section 5.3, these variables are used as the dependent, predicted values for Regression analysis by 12 independent environmental predictors.

ARTIFACT-FREQUENCY COUNTS BY SITE (VAR38 THROUGH 60)

Tool types individually coded for Variable 2 are recoded as Variables 38 through 60; percentage frequency counts by site (Figure 4.6). During the numbering of variables, Number 43 was inadvertently skipped leaving a gap in the tool-frequency series. These Card 3 and 4 records make up an artifact assemblage which expresses the technical activities and tasks which formerly were carried out at each site. The percentage tool list is employed in intersite analysis using a variety of SPSS statistical techniques as well as cluster analysis based on NTSYS (Section 4.3.2.4).

4.3.3.3 ANALYSIS OF THE PREHISTORIC DATA

The prehistoric environmental, artifact, and site data are computer analyzed in three steps: (1) univariate analysis, (2) bivariate analysis, and (3) multivariate analysis (Figure 4.10). In addition, special consideraton is given artifact and site distributional data which is manipulated by means of Nearest Neighbor (N. N.) analysis, NTSYS comparisons, and Z-coordinate cluster mapping.

The six functional and eight evolutionary hypotheses which form the framework of the prehistoric research design were tested in the laboratory using the 59 numbered quantitative variables shown in Figure 4.6. The univariate analyses was employed to test for the normality of the distribution. The bivariate analyses and NTSYS are useful in establishing the functional site types. Predictive modeling, as called for in functional Hypotheses 6, was performed by multiple Regression, a form of multivariate analysis. NTSYS is also used to examine the evolutionary proposition.

COMPUTER PROGRAMMING FOR DATA ANALYSIS

Analyses were accomplished using the CDC Cyber 172 computer at the University of Colorado Computing Center (UCCC), Boulder, Colorado. Various statistical package programs were utilized, including Version 8.0, Statistical Package for the Social Sciences (SPSS); Version 4, Level 2 Numerical Taxonomy System of Multivariate Statistical Programs (NTSYS); and Devise Independent Graphics from Fortran (DIGRAF). Supplementary subroutines and functions in using these programs were provided by the UCCC system. The Nearest Neighbor program is a Fortran program written by Richard E. Oberlin while an undergraduate at the University of Colorado at Boulder (Figure 4.9).

UNIVARIATE STATISTICS

Two SPSS computer programs were run for univariate analysis: FREQUENCIES AND CONDESCRIPTIVE (Nie and others 1975). Subprogram FREQUENCIES produces a one-way

FIGURE 4.9
FLOW CHART SHOWING THE ORDER OF PROGRAM EXECUTIONS FOR THE COMPUTER ANALYSIS OF PREHISTORIC DATA
JOHN MARTIN RESERVOIR PROJECT

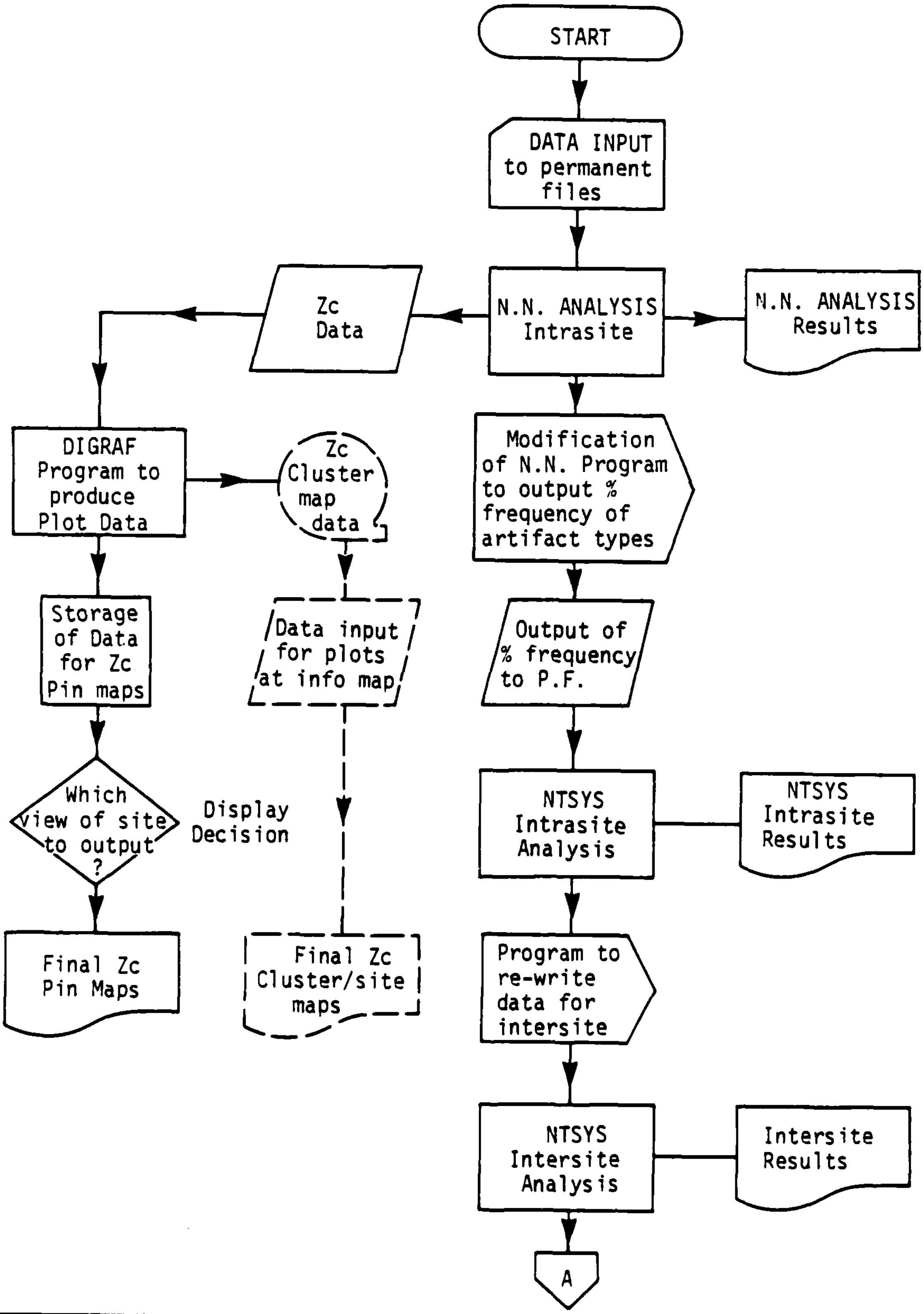


FIGURE 4.9 continued

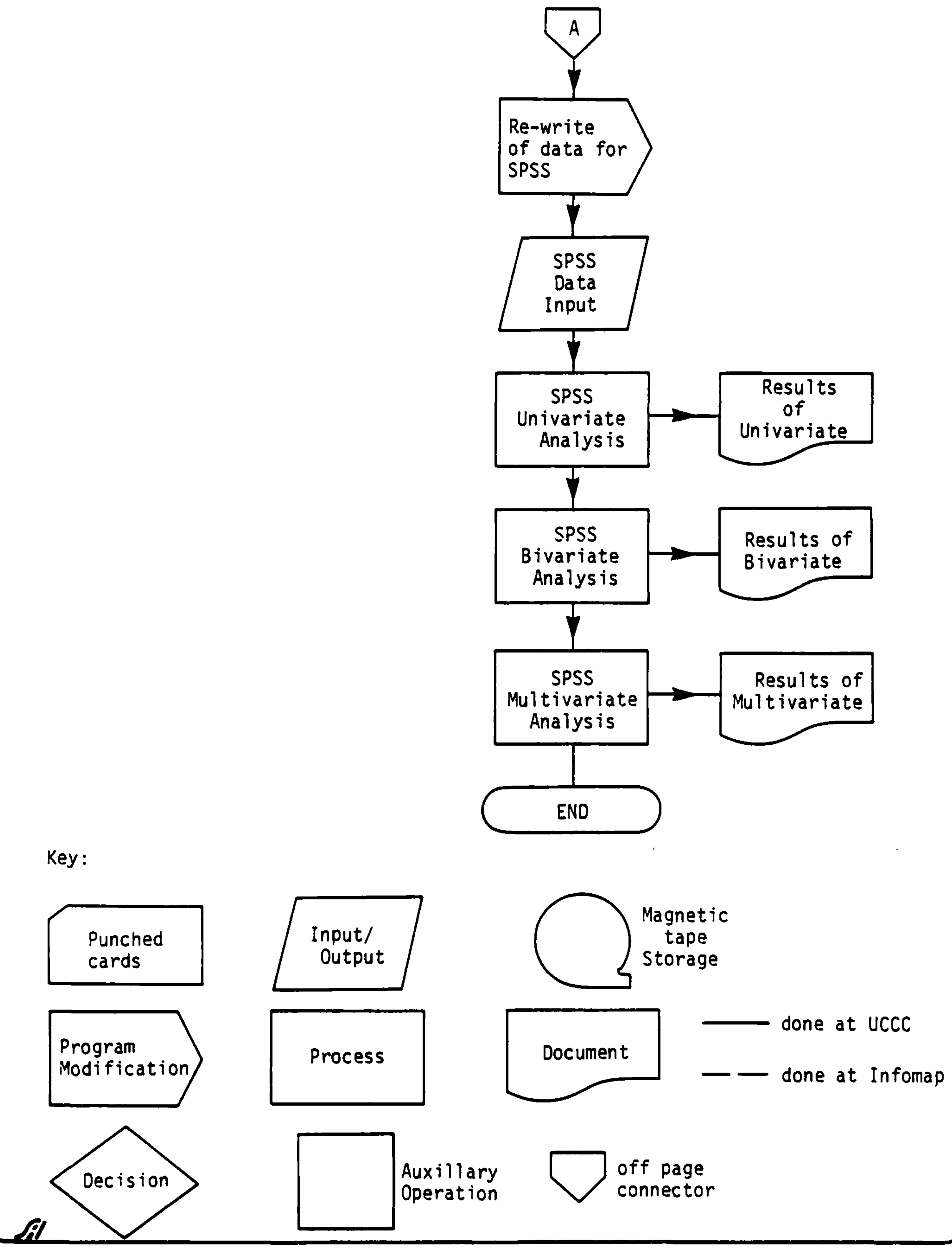


FIGURE 4.10 COMPUTER PROGRAM LIST SHOWING VARIABLES ANALYZED

Univeriate Analysis:

FREQUENCIES PROGRAM: VAR1,8,21-28,32

CONDESCRIPTIVE PROGRAM: VAR9-20,31,33-42,44-60

Bivariate Analysis:

NEAREST NEIGHBOR: VAR4,5

NONPAR CORR: VAR7,33-42,44-60 WITH VAR21-28

CROSSTABS: VAR32 WITH VAR8,21-28

SCATTERGRAM: (Simple Regression): see variables below.

Multivariate Analysis:

REGRESSION (Multiple Regression):

Y-predicted site variables: VAR31,33-37

Y-predicted, X-predictor onsite artifact variables: VAR38-42,44-60.

X-predictor, environmental variables: VAR9-20.

NTSYS (Numerical Taxonomic System) site variables: VAR5,33-37.

frequency distribution with descriptive statistics and tables for nominal variables. The summary statistic options are identical to those for the CONDESCRIPTIVE subprogram. A histogram of these data provides a graphic picture of the same results. CONDESCRIPTIVE is a subprogram to compute descriptive statistics on each variable (Figure 4.10) to include the following: mean, standard error, standard deviation, variance, kurtosis, skewness, range, minimum value, and maximum value. From such a univariate analysis, normality of the frequency distribution is determined. Condescriptive assumes that the data employed is numerically coded and interval in scale.

BIVARIATE STATISTICS

SCATTERGRAM, NONPAR CORR, and CROSSTABS are three SPSS programs utilized to run bivariate analysis of the numbered variables (Figure 4.10). The Scattergram program builds a graph of points expressing the relationship between two interval level variables. A simple Regression line is fitted to the swarm of points with Pearson R (Simple Regression) correlation coefficient computed for the X and Y-axis values. Only bivariate correlations of two-tailed probability significance 0.05 or less are reported.

The NONPAR CORR program computes correlation coefficients on two ordinal level variables which are nonparametric in nature. This program was specifically chosen to capitalize on the ordinal ranking of wildlife, VAR21 through VAR28, and site variables which can be ranked. Only bivariate correlations of 0.05 and less probability significance are reported below.

CROSSTABS is a program which compiles contingency tables between pairs of variables. The Chi-Square statistic is used to test association between the nominal variables of which only those showing a probability significance of 0.05 or less are reported here.

MULTIVARIATE STATISTICS

Two kinds of multivariate programs were run on 99 cases (sites) of John Martin data: REGRESSION and NTSYS. The Regression program was employed to serve as predictive models for site locations (Hypothesis 1.6) and as a retrodictive experiment in order to chose the optimum sample size for survey work.

Subprogram REGRESSION is a multivariate statistic in which many independent variables are regressed against one dependent variable. Variable values should be measured at an interval or ratio scale. Statistical options include: correlation matrix, mean, standard deviation, and number of valid cases.

The NTSYS program is described in a subsequent discussion titled: "Analysis of the Distributional Data" (Section 4.3.3.3).

ANALYSIS OF THE DISTRIBUTIONAL DATA

Distributional analysis of the cultural resources is primarily based on techniques of cluster analysis, specifically the Nearest Neighbor statistic developed by Clark and Evans (1954) and the various statistics of Numerical Taxonomy developed by Sokal and Sneath (1963). Johnson (1968) discusses the use of similarity matrices and coefficients of similarity/dissimilarity as aids in cluster analysis. The use of the dendrogram (phenogram) as a visual representation of clusters, and the levels of association are also discussed in his paper.

Archeological applications of the Nearest Neighbor statistic involve the isolation of patterns of artifact distribution, such as clusters, which may then be used in conjunction with various other analytical techniques to identify and explain work and use activity areas. The theoretical models applicable to the concept of activity areas were developed by Binford (1968), Hill

(1970), Schiffer (1976), Clarke (1968) and others. The use of the Nearest Neighbor technique in archeology is presented in detail by Whallon (1974), Peebles (1973), Hodder and Orton (1978). In archeological research, the mapping of the artifact distribution of a site provides an excellent source of potential point patterns. Unfortunately, with large sites the subjective visual identification of point patterns (clusters) is often very difficult, if not impossible. Oftentimes, different artifact types are mapped together, producing a complex and confusing picture of the site. The Nearest Neighbor statistic, as well as the techniques presented in this section, provide the archeologist with solutions to this problem.

The Nearest Neighbor statistic compares an expected mean distance to the observed (measured) distance from a given point to the nearest neighbor (Clark and Evans 1954). The theoretical (expected) distance is a function of the Chi-Square distribution (Dacey 1963), and is derived from the maximum distances between objects in a random distribution. The statistical significance of deviations from a random distribution as developed by Clark and Evans is based on the normal distribution. Thompson (1956), however, has developed a Chi-Square test of the distribution of Nearest Neighbors; this technique has been used in this analysis when the total number of artifacts (N) is small.

The use of second through nth Nearest Neighbor measurements are mentioned by Clark and Evans as a further possibility in the Nearest Neighbor statistic; however, their discussion is limited to the suggestion of the possibility of deriving further information on the significance of patterns within the distribution. H. R. Thompson (1956) goes beyond this and derives the expected mean distances and standard deviations of second through nth Nearest Neighbor, both under the assumption of normality and the Chi-Square distribution. The normal distribution technique derives the statistical significance of deviations from the mean expected distances. The resulting 'C' score may be compared to the parametric Z score, where the mean is zero, and maximum deviation is unified to 4.0 ± standard deviations. The Chi-Square test is a goodness of fit with alpha at 0.05 (the 95% confidence interval).

NTSYS (Numerical Taxonomy System of Multivariate Statistical Programs et al, 1977) is a variety of subprograms using various cluster and factor analysis techniques developed by Sokal and Sneath (1963). In the analysis of the prehistoric data, this packaged program is used in both the inter and intrasite levels to produce site typologies and intrasite cluster analyses.

The results of this are used to determine objective site typologies based on taxonomic distance. The cluster analysis results are also used to test the hypothesis (H_0) of no significant functional difference between clusters on a site.

The NTSYS program developed for the analyses are the subprograms:

FILES
INPUT
FORMAT
STAND
SIMINT
TAXON
MXCOMP
SUBSETS

The subprograms are broken down as follows. Files designates the system files to be used for input/output. Input gives the dimensions of the data input matrices and provides certain input/output options. Format is the Fortran input format of the data. Stand produces a standardized data matrix from the input data, producing values with a mean of zero and a standard deviation of unity. Simint calculates the correlation (similarity) coefficients from the

standardized data and arranges these values in a symetrical similarity matrix. Taxon is the cluster analysis using an average link (unweighted pair-groups method of association) clustering technique (Sokal and Sneath 1963; Johnson 1968), where high values are considered similar. Taxon then produces a phenogram showing the results of the analysis. Mxcomp calculates a correlation coefficient of the representativeness of the phenogram to the similarity matrix. Values equal to or greater than 0.80 are considered a sufficiently good fit. Subsets is a clustering of items into subsets such that:

"The maximum dissimilarity between members of the subset is less than the least dissimilarity between any member of the subset and any item not in the subset." (NTSYS: subprogram Subsets 1977).

Because of program limitations in core memory, the Subsets subprogram could not be used at the intersite level of analysis; the program remains the same with this exception. Figure 4.11 is a flow diagram and sample programs of the inter and intrasite programming sequences.

THE NEAREST NEIGHBOR PROGRAM

During the summer of 1980, SAI field personnel gathered archeological data in the form of mapped artifact distributions. Each artifact on a site is given polar coordinates of angle and distance (theta, rho). These coordinates are then input as the basic data to the program.

The program was written to measure the distance between each artifact and its nth nearest neighbor. In this study, the ten nearest neighbors were measured although significance is only output to the fifth nearest neighbor. Calculations to the tenth nearest neighbor were necessary for the Z-coordinate cluster techniques discussed in a later section.

Further input to the program consisted of the area (A) of the distribution (in m^2) defined by the extent of that distribution and the total number of artifacts in the distribution (N). Polar coordinates (theta, rho) were transformed to grid coordinates (x, y) using the formulae:

$$X_p = r \text{ Cosine } \Theta \text{ and } Y_p = r \text{ Sin } \Theta$$

It was necessary to reverse the normal formulas in order to obtain distributional plots equal to the field maps (the formulae X=r Sin theta and Y=r Cos theta produced mirror image distributional plots).

The distances for first through tenth nearest neighbor are calculated using the distance formula:

$$d_p = \sqrt{(X_p - X_p - 1)^2 + (Y_p - Y_p - 1)^2}$$
(Where p = points 2 - N)

Several of the sites had multiple datums. The program calculates x, y coordinates for all datums and relates the artifacts from datums B. . . n to the first datum (A) using the transformation formulae:

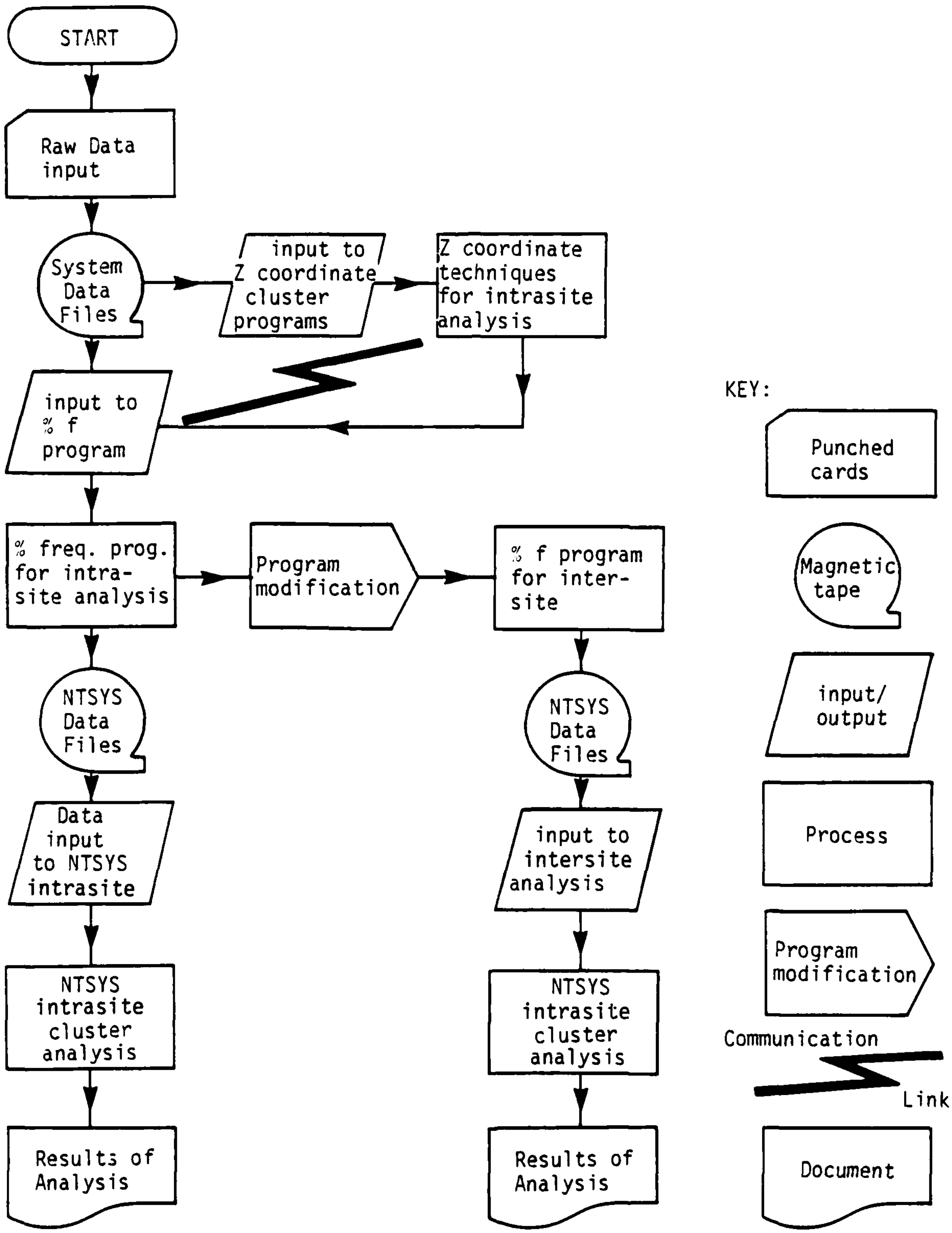
$$X'_p = X_B + X_p$$
$$Y'_p = Y_B + Y_p$$

Where X_B and Y_B are the x, y coordinates of datum B in relation to datum A, X_p and Y_p are the x, y coordinates of artifact (point) p in relation to datum B, and X'_p Y'_p are the new x, y coordinates of artifact p in relation to datum A.

Nearest Neighbor Program: Normal Distribution Subprogram

This subprogram assumes a normal distribution of the points under analysis. Order distances are related to the Chi-Square distribution (Dacey 1963; Thompson 1956); however, even with this skewed distribution, as N increases, and concurrrently the degrees of

FIGURE 4.11
FLOW DIAGRAM OF NTSYS INTER- AND INTRA-SITE ANALYSIS
JOHN MARTIN RESERVOIR PROJECT



freedom increase, the resulting curves tend more and more towards normality. With $N \geqslant 30$ the distribution may be considered to approximate the normal distribution (Siegel 1956: 1-60). The subprogram, therefore, selects sites with $N > 30$, and utilizes the parametric statistics in the analysis (Table 4.1).

Order distances are calculated to the tenth Nearest Neighbor for each point in the distribution. The mean observed distance for each neighbor level is determined, and the expected mean distance calculated. The results of this procedure are then compared for statistical significance in deviation from a random distribution, and the results are output from the computer (Figure 4.11).

For Nearest Neighbor level r_1 (1st N.N.) the statistics are adapted from Clark and Evans (1954). For levels $r_2 \ldots r_n$, statistics were adapted from Thompson (1956). Table 4.2 is adapted from this paper giving the moments and moment-constants of the distribution of r_n.

Theoretically, the statistic for $n = 1$ is based on a two-tailed test. In testing the significance of $r_2 \ldots r_n$, however, if C_1 is significant for either tail (i.e.: if $C_1 \geqslant 1.96$ or $C_1 \leqslant -1.96$) then the test for these levels is effectively one-tailed. For instance, if $C_1 = -1.96$, the distribution tends towards clustering, and R will be < 1.0. At this point, the levels $r_2 \ldots r_n$ will be significant if both $C_i \leqslant -1.65$ and $R_i \leqslant 1.0$.

Another point which should be noted is that at some level of $n < N$, (dependent on n, N, and area) the analysis will produce results showing a tendency for a random distribution, with $R \approx 1.0$.* Continued measurement past this point will produce significance with a tendency towards perfect ordering ($R_n \geqslant 1.0$ and $C_n \geqslant 1.65$). Given $C_1 \geqslant 1.96$ and $R_1 \approx 2.1491$, the reverse sequence may be seen. Exceptions to this would be the so-called perfect cluster, with all points having the same, or approximately the same x, y coordinates, and in a perfectly ordered distribution (a checkerboard pattern).

Nearest Neighbor Program: Chi-Square Distribution Subprogram

Sites with $N \leqslant 30$ are analyzed using the x^2 Nearest Neighbor statistic presented by Thompson (1956). The theoretical derivations for these statistics are discussed by Dacey (1963) and Thompson (1956, Appendix). Thompson gives the following formulaes for determining the expected mean distances and testing significance at alpha = 0.05 (the 95% confidence interval):

$E(\overline{x}_n) = \sqrt{(4Nn - 1)} \mp 1.96)^2/2N$. The results of this calculation are compared to the observed mean distance ($\overline{x}_o$) which is calculated as follows:

$\overline{x}_{o_n} = 2\,\lambda o\; \overline{r}_{n_2}$, where λo is the estimate of the population density: πd.

(In using these formulas, the degrees of freedom are defined by n. So if n = 2, df = 2).

$\overline{x}_o$ is significant if:

$\overline{x}_o \geqslant (\sqrt{(4Nn-1)} + 1.96)^2/2N$ (tendency towards perfect ordering) or

$\overline{x}_o \leqslant (\sqrt{(4Nn-1)} - 1.96)^2/2N$ (tendency towards clustering).

CLUSTER MAPPING OF THE ARTIFACT DISTRIBUTIONS

The Z-coordinate (Z_c) cluster technique was developed by D. Larson (1980) to expand the capabilities of the nth order Nearest Neighbor analysis. The results are a graphic, or visual representation of the distributional patterns based on deviations of an artifact distribution from a random pattern. The technique is based on the ratio of the mean observed distance of neighbor level ($\overline{r}_{o_n}$) to the actual distance from

TABLE 4.1
PARAMETRIC STATISTICS AND GLOSSARY OF SYMBOLS

Symbol	Definition
d	Density
N	Total number of points in the distribution
A	Area of the distribution, in square meters
r_n	Level of neighbor (i.e.: r_2 = 2nd n.n.)
$\sum_{i=1}^{N} r_i$	Sum of distances for N observed distances of ith nearest neighbor
$\bar{r}_o$ $(= \bar{x}_o)$	Mean observed distance
$\bar{r}_e$ $(= \bar{x}_e)$	Mean expected distance
R_n	Ratio of mean observed to mean expected distance for level 1-n.*
$\partial \bar{r}_e$	Standard error of expected mean
C_n	Statistical significance of $\bar{r}_o$ compared to $\bar{r}_e$ for level 1-n

Formulas

$$d = N/A$$

$$\bar{r}_o = \sum_{i=1}^{N} r_i/N$$

$$\bar{r}_e = 1\ (2\sqrt{d}\ )$$

$$R = \bar{r}_o/\bar{r}_e$$

$$\partial \bar{r}_e = 0.26136/\sqrt{Nd}$$

$$C = (\bar{r}_o - \bar{r}_e)/\partial \bar{r}_e$$

*With $R < 1.0$ tendency towards clustering
$R = 1.0$ shows random distribution
$R > 1.0$ shows tendency towards perfect ordering

each artifact to its nth NN.

In a distribution, if $R < 1.0$, a tendency towards clustering is mathematically defined. In order to determine the amount of clustering, Larson developed the Z_c score:

$$Z_c = \sum_{i=2}^{n} (\bar{r}_{o_i}/r_{o_i})$$

Where r_{o_i} is the measured distance from a point to its ith nearest neighbor.

The ratio $\bar{r}_{o_i}/r_{o_i}$ gives a numerical value by which a relative weighting factor may be assigned to each artifact (point) within the distribution. Consider for instance, that the measured distance from a point to its nth n.n. is *less than* the mean observed distance ($\bar{r}_{o_i}$). Then by definition, the ratio of $\bar{r}_{o_i}/r_{o_i}$ will be *greater than* 1.0. By the same logic, if the measured distance is greater than the mean observed distance, the ratio will be less than 1.0. If a point has many close neighbors, the summation of the ratio (Z_c) will produce a relatively large number. Conversely, if a point has few close neighbors, the Z_c will be a smaller number. Further, if the measured distance is approximately equal to the mean observed distance, the Z_c will approximate 1.0.

This allows an assignment of a larger weight to points with many close neighbors, and a relatively smaller weight to points with few close neighbors. The result, then, is that clusters of artifacts will have high Z_c scores, and isolated points will have small Z_c scores.

The computer generated graphic programs were written and developed by Mr. T. Dooley of Infomap, Inc. Boulder, Colorado. The Z_c Cluster Maps (Figure 4.12) were produced in two phases: the first phase uses a DIGRAF program and generates the data necessary to produce the plots. This phase is carried out at the UCCC. The second phase is the actual plotting of the maps, which is carried out at Infomap, using the Applicon plotter. The Z_c Pin Maps are produced at the UCCC from the Tectronix 4014 graphics console and hardcopy printer.

Z_c Cluster Maps

In developing and using the Z_c technique, Larson (1980) and Oberlin (1980) were interested in computer-generated visual representation of the Z_c. The Z_c Cluster Map was suggested by Larson as a way of representing clusters in a two-dimensional x, y grid system. The technique is quite simple and allows a visualization of the clusters that is readily apparent.

Larson saw that in a two-dimensional map, various geometric figures could be used in the second dimension to represent the Z_c. After experimenting with various shapes, he chose the circle as the simplest, both from a mathematical and visual viewpoint. The technique is outlined as follows.

The Z_c value for a point in the distribution is used as the radius of a circle, the scale being equal to the grid scale. A circle is then drawn around this point, with the point as the center (Figure 4.13a). This is repeated for every point in the distribution, producing numerous overlapping circles (Figure 4.13b). Next, the points of overlap at the outer edge of all circles are used as the first level of clustering (Figure 4.13c).

The Z_c values are then consistently factored by a chosen arbitrary value. The values selected for the John Martin Project are 1.0, 0.5, 0.25, producing three levels of clusters: 100%, 50%, and 25%. It should be noted that the Z_c score is a *relative* weighting factor and that Z_c level one need not be 100%. In fact, as long as consistency is maintained for all Z_c levels, any value may be used to factor. This allows flexibility in produc-

TABLE 4.2
MOMENTS AND MOMENT-CONSTANTS OF THE DISTRIBUTION OF THE R STATISTIC

n	1	2	3	4	$\geqslant 5$
$E(r_n)$	$0.5000/\sqrt{d}$	$0.7500/\sqrt{d}$	$0.9375/\sqrt{d}$	$1.0937/\sqrt{d}$	For $n > 4$, $E(r_n) = 0.5642/\sqrt{d}$ and $\partial(r_n) = 0.2821/\sqrt{d}$ (Thompson 1956:392)
$\partial(r_n)$	$0.2614/\sqrt{d}$	$0.2723/\sqrt{d}$	$0.2757/\sqrt{d}$	$0.2774/\sqrt{d}$	
B_1	0.644	0.406	0.318	0.269	
B_2	3.245	3.059	3.025	3.105	

FIGURE 4.12
SCATTERGRAM CLUSTER MAP OF JM005
JOHN MARTIN RESERVOIR PROJECT

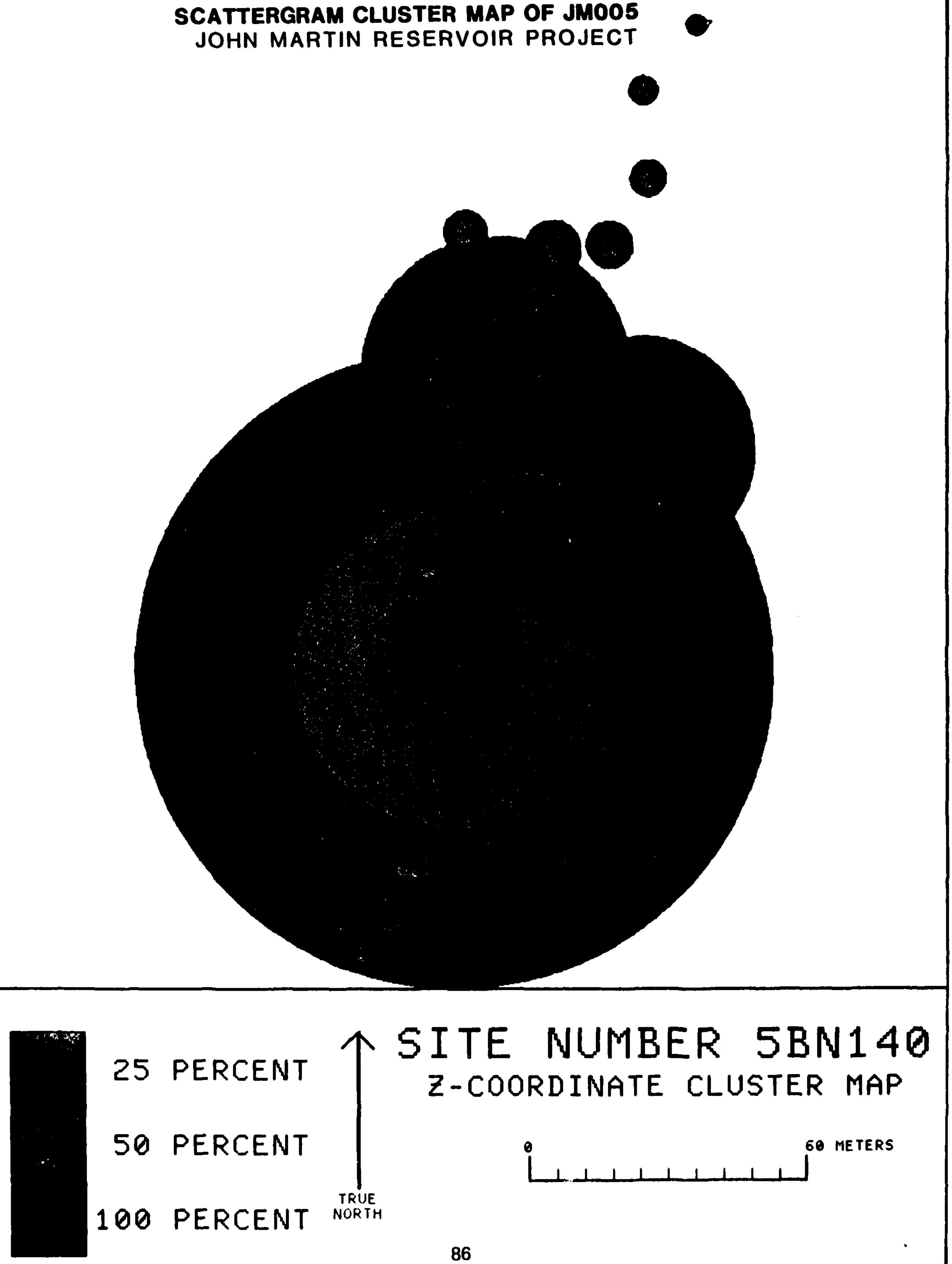
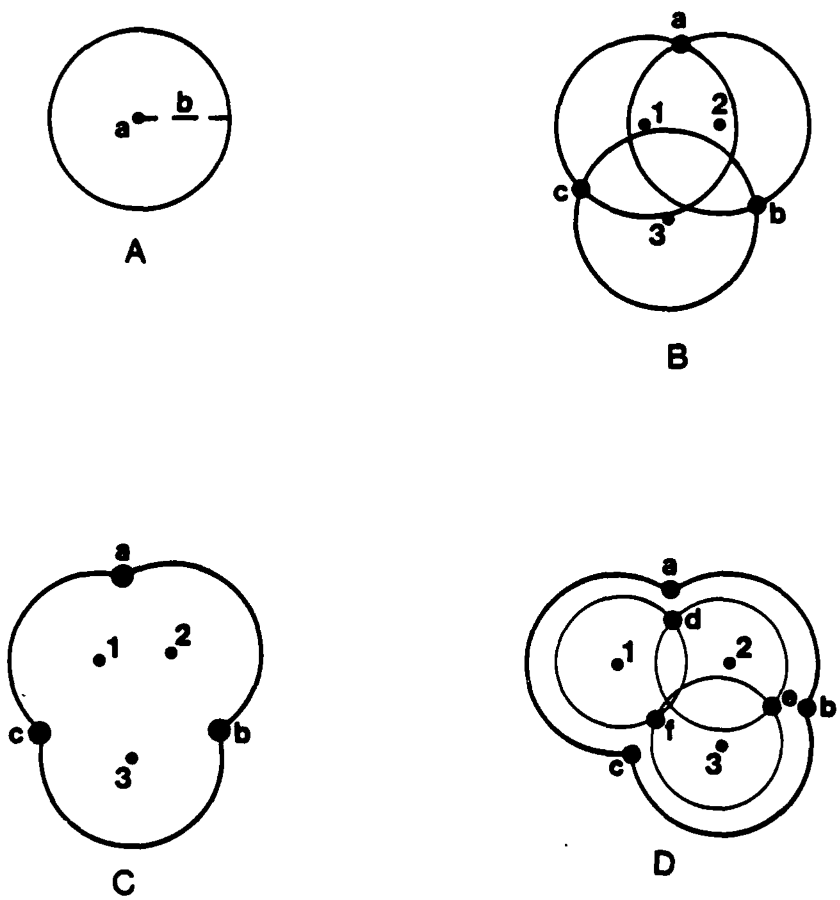


FIGURE 4.13
DIAGRAMS SHOWING STEPS IN Z-COORDINATE MAPPING
JOHN MARTIN RESERVOIR PROJECT



ing the maps.

The second level of clustering is produced as 0.5 (Z_c) for all Z_c's in the distribution. This factored score is then used as a radius for the second level (Figure 4.13d). Again, only the outer segments of the circle are retained. This procedure is repeated using 0.25 (Z_c) for the third level. This factoring may be carried out until individual points are isolated at the final level. Figure 4.12 is an example of the final Z_c cluster maps produced for the project.

The potential usefulness of isolating individual points may be seen if the researcher is interested in visualizing specific point patterns in the distribution. In analyzing a large site, with a plethora of artifacts and/or structural remains, each group of artifact and/or structural types may be color coded at the innermost Z_c level. This would allow the researcher to visually determine activity areas, foundations/ pylons, and so forth, by simply looking at the resultant Z_c Cluster Map.

Z_c Pin Maps

The Z_c Pin Map (Figure 4.14) is a three-dimensional graphic representation of the point distribution developed by Oberlin (1980). Here, the Z_c is used as the z axis of the three-dimensional map. The height of the Z_c is a scale value plotted along the z axis, with the individual point as the base. This allows a quick visual interpretation of clusters and/or patterns in the distribution. It is also a good example of the flexibility of the Z_c in types of graphic representation. Again, the Z_c's may be factored to produce only those clusters which are significant or of specific interest to the researcher.

SUMMARY OF SECTION 4.3.3.3

This section has covered the various statistical procedures employed in testing the functional and evolutionary hypotheses. Due to the large amount of artifactual and site data, a computer file was built on 99 of the prehistoric sites; selection being based on number of artifacts. This data was analyzed using a series of programs to include: SPSS, NTSYS, and DIGRAF. The actual analyses are presented in terms of univariate, bivariate, and multivariate statistics. In addition, both intra and intersite distributional studies were performed on artifactual and site data using the NN and Z-coordinate cluster techniques.

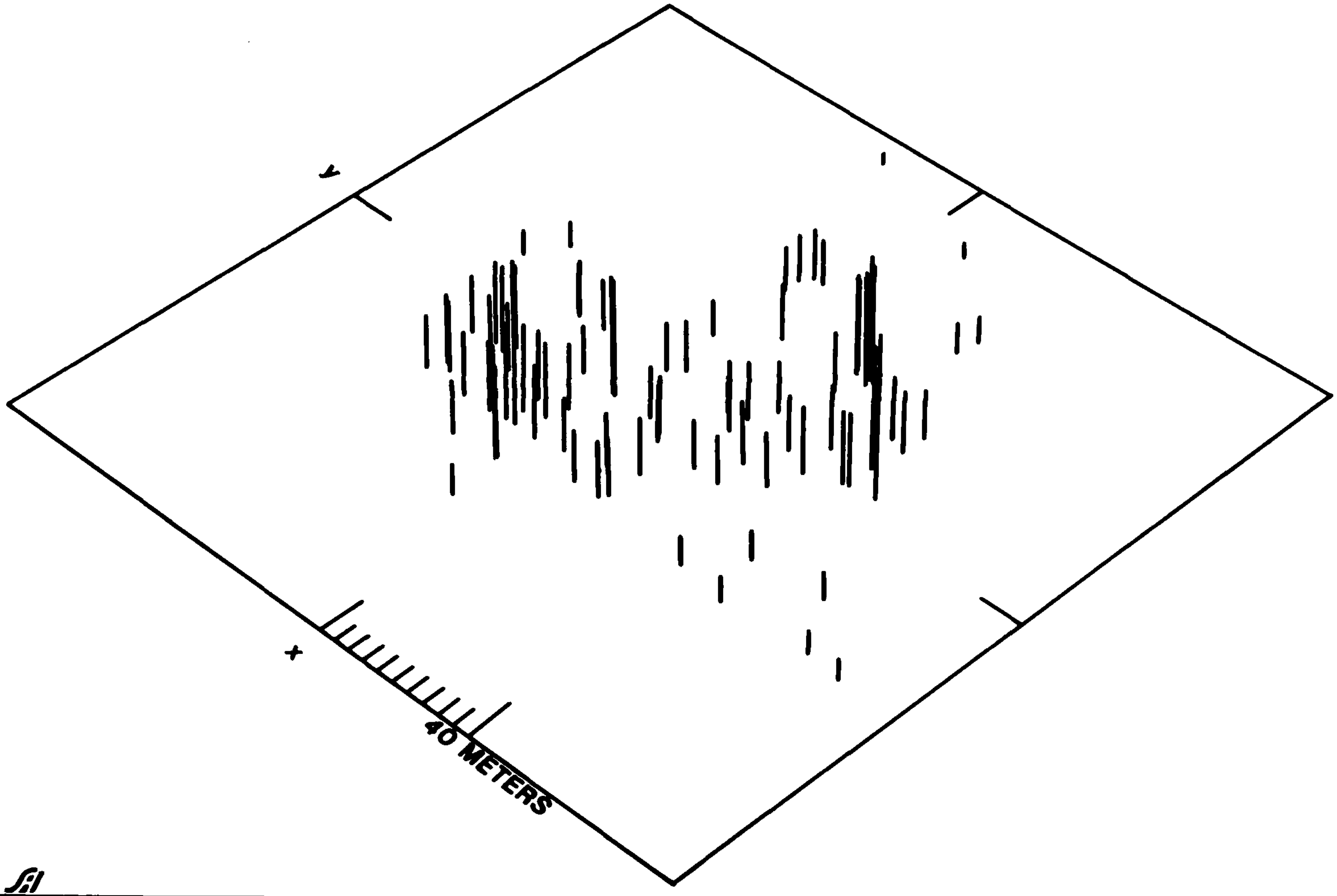
4.4 SUMMARY

The prehistoric research design presented in this section is composed of three aspects: 1) regional overview, 2) regional research questions and 3) John Martin research questions. The Regional Overview is a cultural history of 12,000 years of human occupation in southeastern Colorado. It was compiled from a review of the regional literature for purposes of providing a backdrop for the John Martin archeology and to orient the field investigators as to expectable finds.

Aspect 2 of the Research Design is a treatment of the regional research questions. Again working from the archeological literature of southeastern Colorado, a review was made of the current and timely research questions. These were presented as three topics: chronological controls, functional lifeway questions, and evolutionary questions. It was from these topic areas, then, that the local John Martin hypotheses were developed.

The actual questions for the John Martin research, Aspect 3 of the Research Design, are presented in terms of the Method of Hypotheses Testing. This deductive design works from general propositions through hypotheses, test implications, to statistical treatment of the data. The research was organized according to two proposi-

FIGURE 4.14
Z-COORDINATE PIN MAP OF JM016 SHOWING LOCATION OF STONE ARTIFACTS CLUSTERINGS IN THREE DIMENSIONS
JOHN MARTIN RESERVOIR PROJECT



tions: one functional and the other evolutionary. However, a caution was introduced to the effect that the ability to satisfactorily address these propositions is limited by our ability to accurately date the artifactual and site data against which they will be examined; a topic to be confronted in Section 5.0 where we will describe the survey data base and its adequacy for evaluation of the *prehistoric hypotheses.*

SECTION 5.0
DESCRIPTION OF THE PREHISTORIC SURVEY DATA BASE

by Frank W. Eddy, J. Jan Reining, Beverly Leichtman

In the following section, the cultural resource properties of the John Martin Reservoir area are described as the data base for examining the research questions outlined in Section 4.0. Subsections to be covered in this treatment are: 1) field methods, 2) univariate analysis of variables, 3) collected artifact descriptions, 4) site chronology, 5) rock art, 6) testing of sites, and 7) a description of unique sites. The section summary will consider the adequacy of this data for hypotheses testing.

The prehistoric survey data base is described in terms of 7 artifact and 31 onsite variables. Twenty-one other environmental variables are described in Section 3.4 to form a total of 59 measures of site variability. Artifacts were recognized in the field as being objects of human manufacture and/or use. The bulk of such specimens are made of stone (lithics) although rare specimens of bone or ceramic manufacture were also recorded.

One or a few such specimens were recorded as an Isolated Find (IF No.), whereas ten or more specimens occurring in a cluster were said to constitute an archeological site (JM No.). IFs are thought to reflect past land-use practices such as hunting, plant gathering, farming, or some general transitory movement through the countryside. In contrast, the denser aggregation of artifacts constituting a site reflect temporary or permanent encampments for some period of time greater than an hour or two. Sites are the result of camping for resource exploitation (special-activity sites), seasonal base camps, or houses of sedentary farmers. In the project area, sites were marked by scatters of artifacts without evidence of a midden matrix. Lithic scatters were found in the open as well as under bedrock overhangs. Other classes of artifacts found on sites are potsherds fire hearths, scattered hearth-stones (burned rock) and/or dry laid masonry walls. Other sites consist of rock art of pecked or incised drawings executed on the cliff face of a sandstone outcrop.

Results of the site survey yielded an inventory of 133 archeological sites of which 111 carried components of prehistoric occupation. In addition, 103 other finds were stray artifacts labeled IFs. Table 5.1 provides a listing of these sites and their attributes. Figure 5.1 is a map showing the distribution of the prehistoric sites within the project boundaries.

5.1 FIELD METHODS

The goal of fieldwork is to obtain accurate, descriptive field data in a manner congruent with the Problem Orientation as a Bias (Section 4.3.1). Further considerations in data acquisition are the need to collect information for culture resource management purposes (Section 11.0).

5.1.1 COVERAGE

In conformance with the contract Scope of Work, SAI conducted an intensive pedestrian survey of the John Martin Reservoir, covering the complete project fee and easement land (Figure 2.2).

The survey was conducted by three, three-person crews, composed of a crew leader and two crew members. Each crew was assigned a one-section parcel (one square mile in size) to be swept in passes. The crew skirmish line was deployed at 25 m intervals so that a given pass covered 100 m (330 feet). At the section line, the crew pivoted for its return pass; an operation which was repeated accurately 16 times to complete the section parcel coverage. Areas not actually walked because of obscuring sedimentation,

Table 5.1
Data by Site

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM001 (5BN136) Siglea Homestead	Sec. 6, T23S, R49W 3855 ft.	Farmstead	40.9 m^2/structure/NA	Euro-American/1919-1940
JM002 (5BN137)	Sec. 6, T23S, R49W 3855-3880 ft.	Trash scatter	12,993 m^2/historic refuse/NA	Euro-American/1890-1940
JM003 (5BN138)	Sec. 1, T23S, R50W 3870 ft.	Trash scatter	1,875 m^2/historic refuse/NA	Euro-American/1880-1900
JM004 (5BN 139)	Sec. 1, T23S, R50W 3855 ft.	Trash scatter	25,200 m^2/historic refuse/NA	Euro-American/1920-1940
JM005 (5BN140)	Sec. 1, T23S, R49W 3870 ft	Type 1.1 Special activity site	10,500 m^2/lithics/3	Prehistoric/unknown
JM006 (5BN141)	Sec. 1, T23S. R50W 3880 ft.	Camp/ Trash scatter	19,500 m/lithics, historic refuse/NA	Prehistoric/Euro-American/unknown
JM007 (5BN2)	Sec. 1, T23S, R50W 3855 ft.	Type 1.2	6,000 m^2/lithics/2	Prehistoric/unknown
JM008 (5BN142)	Sec. 1, T23S, R50W 3855 ft.	Type 1.4 Hunting camp	43,750 m^2/lithics/4	Prehistoric/unknown
JM009 (5BN143)	Sec. 1, T23S, R50W 3860 ft.	Type 1.4 Hunting camp	18,200 m^2/lithics/2	Prehistoric/unknown
JM010 (5BN144)	Sec. 1, T23S, R50W 3860 ft.	Type 1.3 Special activity site	15,000 m^2/lithics/4	Prehistoric/unknown
JM011 (5BN145)	Sec. 1, T23S, R50W 3855 ft.	Type 1.3, Special activity site	5,625 m^2/lithics/6	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM012 (5BN146)	Sec. 1, T23S, R50W 3865 ft.	Type 1.3 Special activity site	10,710 m^2/lithics/6	Prehistoric/unknown
JM013 (5BN147)	Sec. 1, T23S, R50W 3870 ft.	Type 1.5 Special activity site	6,900 m^2/lithics/5	Prehistoric/unknown
JM014 (5BN148)	Sec. 1, T23S, R50W 3885 ft.	Type 1.3 Special activity site	1,925 m^2/lithics/1	Prehistoric/unknown
JM015 (5BN149)	Sec. 1, T23S, R50W 3880 ft.	Isolated find	600 m^2/lithics/1	Prehistoric/unknown
JM016 (5BN150)	Sec. 1, T23S, R50W 3865 ft.	Type 1.3 Special activity site	25,000 m^2/lithics/6	Prehistoric/unknown
JM017 (5BN151)	Sec. 1, T23S, R50W 3865 ft.	Type 1.3 Special activity site	7,500 m^2/hearth/5	Prehistoric/unknown
JM018 (5BN152)	Sec. 1, T23S, R50W 3875 ft	Type 4.0 Un-differentiated/ trash scatters	4,000 m^2/lithics/ historic refuse/1	Euro-American/unknown Prehistoric/unknown
JM019 (5BN153)	Sec. 1, T23S, R50W 3865 ft.	Type 1.3 Special activity site	11,250 m^2/lithics/7	Prehistoric/unknown
JM020 (5BN154)	Sec. 1, T23S, R50W 3870 ft.	Trash scatter	100 m^2/historic refuse/NA	Euro-American/unknown
JM021 (5BN155)	Sec. 1, T23S, R50W 3880 ft.	Type 1.5 Special activity site	3,840 m^2/lithics/2	Prehistoric/unknown
JM022 (5BN156)	Sec. 2, T23S, R50W 3825 ft.	Type 6.0, Base camp	25 m^2/blade cache/1	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM023 (5BN157)	Sec. 1, T23S, R50W 3890 ft.	Type 1.4 Hunting camp	450 m^2/hearth/3	Prehistoric/unknown
JM024 (5BN158)	Sec. 2, T23S, R50W 3875 ft.	Type 1.5, Special activity site	1,344 m^2/hearth/1	Prehistoric/unknown
JM025 (5BN159)	Sec. 1, T23S, R50W 3830 ft.	Type 1.4 Hunting camp/ Trash scatter	1,120 m^2/lithics, pottery/ historic refuse/2	Prehistoric/unknown Euro-American/unknown
JM026 (5BN160)	Sec. 2, T23S, R50W 3873 ft.	Type 1.5 Special activity site	2,160 m^2/lithics/5	Prehistoric/unknown
JM027 (5BN161)	Sec. 2, T23S, R50W 3840 ft.	Type 1.3 Special activity site	750 m^2/lithics/2	Prehistoric/unknown
JM028 (5BN162)	Sec. 2, T23S, R50W 3872 ft.	Type 1.4 Hunting camp	2,500 m^2/hearth/2	Prehistoric/unknown
JM029 (5BN163) Baldwin Homestead	Sec. 35, T22S, R50W 3890 ft.	Farmstead	21,000 m^2/structure with with associated outbuildings	Euro-American/1900-1940
JM030 (5BN164)	Sec. 2, T23S, R50W 3835 ft.	Unclassified, camp	1,600 m^2/3 stone tipi rings/3	Prehistoric/ protohistoric period
JM031 (5BN165)	Sec. 17, T23S, R50W 3835 ft.	Type 4.0 Un-differentiated	1,500 m^2/scattered hearthstones/1	Prehistoric/unknown
JM032 (5BN166)	Sec. 17, T23S, R50W 3880 ft.	Type 1.5 Special activity site	6,000 m^2/scattered hearthstones/3	Prehistoric/unknown
JM033 (5BN167)	Sec. 8, T23S, R50W 3845 ft.	Type 5.1 Special activity site	3,500 m^2/scattered hearthstones/1	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM034 (5BN168)	Sec. 5, T23S, R50W 3842 ft.	Type 5.1 Special activity site	4,900 m^2/hearth/8	Prehistoric/unknown
JM035 (5BN169)	Sec. 5, T23S, R50W 3845 ft.	Type 5.2 Hunting camp	6,000 m^2/hearth/4 A.D. 1000	Post-Woodland/after
JM036 (5BN170)	Sec. 5, T23S, R50W 3845 ft.	Type 5.1 Special activity site	500 m^2/lithics/3	Woodland through Dismal River/A.D. 250-1700
JM037 (5BN171) Huey Ranch	Sec. 7, T23S, R50W 3845 ft.	Ranch related	1,272 m^2/water trough, structural remains/NA	Euro-American/1919-1940
JM038 (5BN101)	Sec. 6, T23S, R50W 3870 ft.	Type 7.1 Base camp	15,000 m^2/6 hearths/7	Prehistoric/unknown
JM039 (5BN172)	Sec. 10, T23S, R51W 3875 ft.	Type 6.1 Base camp/ Trash scatter	2,500 m^2/1 stone circle, historic refuse/1	Prehistoric/Euro-American/ unknown
JM040 (5BN173)	Sec. 10, T23S, R51W 3875 ft.	Trash scatter	1,200 m^2/historic refuse/NA	Euro-American/
JM041 (5BN174) Dobbins House	Sec. 7, T23S, R51W 3875 ft.	Farmstead	50 m^2/house, cistern/NA	Euro-American/1894-1940
JM042 (5BN175) Beach House	Sec. 8, T23S, R51W 3875 ft.	Farmstead	400 m^2/house/NA	Euro-American/1914-1940
JM043 (5BN176) Old Las Animas	Sec. 8, T23S, R51W 3870 ft.	Type 1.1 Special activity site/ Townsite	96,000 m^2/foundations, structures, lithic scatter/3	Euro-American/1869-1887 Late Archaic through Plains-Woodland, Post-Woodland/1000 B.C. to A.D. 1000, after A.D. 1000

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM044 (5BN177)	Sec. 10, T23S, R51W 3840 ft.	Ranch related	?/stone fence/NA	Euro-American/unknown
JM051 (5BN178)	Sec. 33, T22S, R50W 3860 ft.	Type 6.2 Base camp	3,575 m^2/lithics/6	Prehistoric/unknown
JM052 (5BN179)	Sec. 33, T22S, R50W 3855 ft.	Type 6.2 Base camp	961 m^2/lithics/NA	Prehistoric/unknown
JM053 (5BN180)	Sec. 33, T22S, R50W 3885 ft.	Type 1.4 Hunting camp	2,860 m^2/lithics/2	Prehistoric/unknown
JM054 (5BN181)	Sec. 33, T22S, R50W 3870 ft.	Isolated find	399 m^2/lithics/NA	Prehistoric/unknown
JM055 (5BN182)	Sec. 33, T22S, R50W 3880 ft.	Type 1.2 Hunting camp/ Trash scatter	608 m^2/lithics, historic refuse/4	Prehistoric/unknown Euro-American/1920s
JM056 (5BN183) Irvine Homestead	Sec. 33, T22S, R50W 3850 ft.	Farmstead	395 m^2/foundation/NA	Euro-American/1889-1940
JM057 (5BN184)	Sec. 4, T22S, R50W 3860 ft.	Type 5.2 Hunting camp	1,056 m^2/lithics/3	Prehistoric/unknown
JM058 (5BN185)	Sec. 4, T22S, R50W 3850 ft.	Type 5.1 Special activity site	2,880 m^2/lithics/3	Prehistoric/unknown
JM059 (5BN121)	Sec. 4, T23S, R50W 3850 ft.	Type 1.2 Special activity site, Hunting camp	2,304 m^2/lithics/5	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM060(5BN186)	Sec. 4, T23S, R50W 3845 ft.	Type 3.0 Undifferentiated	1,416 m^2/hearth/3	Early Middle Archaic/ 5500-1000 B.C.
JM061 (5BN187)	Sec. 3, T23S, R50W 3835 ft.	Type 1.4 Special activity site, Hunting camp	1,440 m^2/lithics/2	Post-Woodland/A.D. 1000-1700
JM062 (5BN188)	Sec. 3, T23S, R50W 3835 ft.	Type 3.0 Undifferentiated	1,050 m^2/hearth/8	Prehistoric/unknown
JM063 (5BN189)	Sec. 3, T23S, R50W 3830 ft.	Type 3.0 Undifferentiated	1,280 m^2/scattered hearthstone/4	Prehistoric/unknown
JM064 (5BN190)	Sec. 3, T23S, R50W 3848 ft.	Type 1.2 Special activity site	5,950 m^2/lithics/3	Prehistoric/unknown
JM065 (5BN191) Frank Baldwin Ranch	Sec. 3, T23S, R50W 3845 ft.	Farmstead	1,050 m^2/house foundation, possible well, privy/NA	Euro-American/1915-1940
JM066 (5BN192)	Sec. 3, T23S, R50W 3842 ft.	Type 1.4 Special activity site, Hunting camp	18,000 m^2/lithics/3	Prehistoric/unknown
JM067 (5BN193)	Sec. 34, T22S, R51W 3865 ft.	Type 1.1 Special activity site	5,400 m^2/scattered hearthstones/6	Prehistoric/unknown
JM068 (5BN194)	Sec. 34, T22S, R51W 3865 ft.	Type 1.1 Special activity site	14,300 m^2/scattered hearthstones/6	Prehistoric/unknown
JM069 (5BN195) Pierce Homestead	Sec. 34, T22S, R51W 3862 ft.	Type 1.2 Special activity site, Hunting camp, Farmstead	10,218 m^2/foundation, lithics/3	Prehistoric/unknown Euro-American/1888-1940

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM070 (5BN196)	Sec. 35, T22S, R51W 3880 ft.	Type 1.3 Special activity site	2,516 m^2/lithics/2	Prehistoric/unknown
JM071 (5BN197) Gass Homestead	Sec. 35, T22S, R51W 3880 ft.	Farmstead	5,942 m^2/sandstone foundation, cistern, privy, possible outbuildings/NA	Euro-American/1899-1940
JM072 (5BN198)	Sec. 35, T22S, R51W 3895 ft.	Type 5.3 Special activity site	1,760 m^2/lithics/3	Prehistoric/unknown
JM073 (5BN199)	Sec. 35, T22S, R51W 3875 ft.	Type 5.3 Special activity site	3,200 m^2/lithics/9	Prehistoric/unknown
JM074 (5BN200)	Sec. 35, T22S, R51W 3865 ft.	Type 1.4 Special activity site	2,500 m^2/lithics/4	Prehistoric/unknown
JM075 (5BN201)	Sec. 35, T22S, R51W 3860 ft.	Type 5.1 Special activity site	1,935 m^2/lithics/5	Prehistoric/unknown
JM076 (5BN202)	Sec. 35, T22S, R51W 3885 ft.	Type 2.0 Hunting camp	2,013 m^2/lithics/6	Prehistoric/unknown
JM077 (5BN118)	Sec. 35, T22S, R51W 3870 ft.	Rock shelter	56 m^2/none/1	Prehistoric/unknown
JM078 (5BN203) Fannie Clay Homestead	Sec. 26, T22S, R51W 3890 ft.	Farmstead	1,920 m^2/foundation, possible outbuildings/NA	Euro-American/1910-1940
JM079 (5BN204)	Sec. 35, T22S, R51W 3870 ft.	Type 2.0 Hunting camp	4,500 m^2/lithics/3	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM080 (5BN205)	Sec. 35, T22S, R51W 3860 ft.	Rock shelter	9 m^2/none/1	Prehistoric/unknown
JM081 (5BN206)	Sec. 35, T22S, R51W 3860 ft.	Rock shelter	38 m^2/stone wall enclosure/1	Formative/A.D. 250-1300
JM082 (5BN207)	Sec. 36, T22S, R51W 3860 ft.	Type 1.3 Special activity site	12,240 m^2/2 hearths/5	Prehistoric/unknown
JM083 (5BN208) Ford House	Sec. 25, T22S, R51W 3860 ft.	Farmstead	3,500 m^2/foundation/NA	Euro-American/1900-1940
JM084 (5BN209)	Sec. 25, T22S, R51W 3865 ft.	Type 4.0 Un-differentiated	20,800 m^2/lithics/4	Prehistoric/unknown
JM085 (5BN210)	Sec. 25, T22S, R51W 3855 ft.	Type 2.0 Hunting camp	27,200 m^2/lithics/4	Prehistoric/unknown
JM086 (5BN211)	Sec. 36, T22S, R51W 3870 ft.	Type 2.0 Hunting camp	9,568 m^2/lithics/6	Prehistoric/unknown
JM087 (5BN212)	Sec. 31, T22S, R50W 3855 ft.	Type 2.0 Hunting camp	7,392 m^2/hearth/5	Prehistoric/unknown
JM088 (5BN213)	Sec. 31, T22S, R50W 3860 ft.	Type 5.2 Special activity site, Hunting camp	8,640 m^2/6 hearths/7	Prehistoric/unknown
JM089 (5BN214)	Sec. 31, T22S, R50W 3862 ft.	Type 2.0	5,760 m^2/lithics/1	Prehistoric/unknown
JM090 (5BN215)	Sec. 31, T22S, R50W 3855 ft.	Type 5.2 Special activity site, Hunting camp	3,000 m^2/lithics/5	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters	Cultural Affiliation (Component)/(Age)
JM091 (5BN216)	Sec. 32, T22S, R50W 3852 ft.	Type 5.2 Special activity site, Hunting camp	2,000 m^2/lithics/7	Prehistoric/unknown
JM092 (5BN217)	Sec. 31, T22S, R50W 3855 ft.	Type 2.0 Hunting camp	4,056 m^2/lithics/5	Prehistoric/unknown
JM093 (5BN218)	Sec. 31, T22S, R50W 3858 ft.	Type 5.2 Special activity site, Hunting camp	1,560 m^2/lithics/3	Prehistoric/unknown
JM094 (5BN219)	Sec. 32, T22S, R50W 3852 ft.	Type 5.2 Special activity site, Hunting camp	1,050 m^2/lithics/2	Prehistoric/unknown
JM095 (5BN220)	Sec. 32, T22S, R50W 3865 ft.	Type 1.4 Special activity site, Hunting camp	2,760 m^2/lithics/4	Prehistoric/unknown
JM096 (5BN221)	Sec. 29, T22S, R50W 3875 ft.	Type 5.2 Special activity site, Hunting camp	1,665 m^2/3 hearths, possible circular stone ring/1	Prehistoric/unknown
JM097 (5BN222)	Sec. 29, T22S, R50W 3862 ft.	Type 1.4 Special activity site	2,146 m^2/none/3	Prehistoric/unknown
JM098 (5BN223)	Sec. 29, T22S, R50W 3880 ft.	Type 5.2 Special activity site, Hunting camp	64,218 m^2/lithics/7	Prehistoric/unknown
JM099 (5BN223)	Sec. 22, T22S, R50W 3875 ft.	Type 5.2 Special activity site, Hunting camp	87,500 m^2/hearth/5	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM100 (5BN224)	Sec. 32, T22S, R50W 3821 ft.	Type 2.0 Hunting camp	5,000 m^2/hearth/7	Prehistoric/unknown
JM101 (5BN225) Myers Homestead	Sec. 32, T22S, R50W 3865 ft.	Farmstead	53 m^2/sandstone foundation/NA	Euro-American/1923-1940
JM102 (5BN226)	Sec. 18, T23S, R49W 3855 ft.	Isolated find	1,750 m^2/none/1	Prehistoric/unknown
JM103 (5BN227)	Sec. 13, T23S, R50W 3855 ft.	Type 4.0 Undifferentiated	258 m^2/hearth/1	Prehistoric/unknown
JM104 (5BN14)	Sec. 14, T23S, R50W 3850 ft.	Type 6.2 Base camp	1,000,000 m^2/hearths, 1 rock art panel/7	Late Plains Archaic/ 1000 B.C.-A.D. 250
JM105 (5BN228) Graham Homestead	Sec. 13, T23S, R50W 3860 ft.	Farmstead	5,250 m^2/foundation, cistern/NA	Euro-American/1891-1940
JM106 (5BN229)	Sec. 13, T23S, R50W 3835 ft.	Type 7.0 Base camp	800 m^2/5 scattered hearthstones/1	Prehistoric/unknown
JM107 (5BN230)	Sec. 13, T23S, R50W 3825 ft.	Isolated find	154 m^2/hearth/1	Prehistoric/unknown
JM108 (5BN231)	Sec. 11 and 12, T23S, R50W	Type 7.1 Base camp	200,000 m^2/hearth, scattered hearthstones/4	Prehistoric/unknown
JM109 (5BN232)	Sec. 14, T23S, R50W 3855 ft.	Type 5.3 Special activity site	5,000 m^2/scattered hearthstones/4	Early Archaic/5500-3000 B.C.
JM110 (5BN233)	Sec. 14, T23S, R50W 3825 ft.	Type 7.1 Base camp	50,000 m^2/scattered hearthstones/3	Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM111 (5BN234) Bromley Homestead	Sec. 14, T23S, R50W 3855 ft.	Farmstead foundations/NA	3,055 m^2/(6) structural	Euro-American 1920-1940
JM112 (5BN235)	Sec. 14, T23S, R50W 3825 ft.	Type 7.2 Base camp	9,400 m^2/hearth/1	Prehistoric/unknown
JM113 (5BN236)	Sec. 10, T23S, R50W 3815 ft.	Type 7.3 Base camp	7,600 m^2/metate cluster/4	Prehistoric/unknown
JM114 (5BN237)	Sec. 10, T23S, R50W 3860 ft.	Type 7.1 Base camp	6,000 m^2/lithics/5	Prehistoric/unknown
JM115 (5BN238)	Sec. 10, T23S, R50W 3885 ft.	Type 4.0 Undifferentiated	40,000 m^2/lithics/3	Prehistoric/unknown
JM116 (5BN239)	Sec. 10, T23S, R50W 3890 ft.	Type 5.2 Special activity site, Hunting camp	125,000 m^2/lithics/4	Prehistoric/unknown
JM117 (5BN122)	Sec. 9, T23S, R50W 3870 ft.	Type 5.2 Special activity site,	30,000 m^2/stone wall, 5 rock art panels/6	Post-Woodland/A.D. 1000
JM118 (5BN240)	Sec. 16, T23S, R50W 3875 ft.	Type 6.2 Base camp	1,645 m^2/lithics/3	Prehistoric/unknown
JM119 (5BN241) Gerstenkorn Ranch	Sec. 21, T23S, R50W 3840 ft.	Farmstead/ Type 7.2 Base camp	42,000 m^2/scattered hearthstones, historic foundations/2	Euro-American/1925 ~~1920-1930~~ Prehistoric/unknown
JM120 (5BN242) Carrie Allen Homestead	Sec. 20, T23S, R50W 3875 ft.	Farmstead/ Type 6.1 Base camp	41,250 m^2/rock cairn, historic foundations/2	Euro-American/1913-1940 Prehistoric/unknown

Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM121 (5BN243) Carrie Allen Homestead	Sec. 20, T23S, R50W 3855 ft.	Ranch related	875 m^2/cistern/1	Euro-American/1913-1940
JM122 (5BN244)	Sec. 20, T23S, R50W 3880 ft.	Type 3.0 Undifferentiated	4,000 m^2/lithics/1	Prehistoric/unknown
JM123 (5BN245)	Sec. 19, T23S, R50W 3910 ft.	Type 6.0 Base camp	20,000 m^2/hearth, scattered hearthstones, stone alignment/1	Early Archaic/5500 to 3000 B.C.
JM124 (5BN246)	Sec. 19, T23S, 3880 ft.	Residence	168 m^2/stone wall enclosure, house/1	Formative/A.D. 250-1300
JM125 (5BN247)	Sec. 20, T23S, R50W 3855 ft.	Type 6.1, Base camp/Trash scatter	9,000 m^2/hearth, scattered hearthstones/1	Prehistoric/unknown
JM126 (5BN248)	Sec. 19, T23S, R50W 3915 ft.	Type 6.2 Base camp	35,000 m^2/3 hearths, scattered hearthstones, stone circle/4	Post-Woodland/A.D. 1000 to 1700
JM127 (5BN249)	Sec. 19, T23S, R50W 3870 ft.	Ranch related	1,824 m^2/dam/1	Euro-American/unknown
JM128 (5BN007) Hicklin Springs Site	Sec. 19, T23S, R50W 3875 ft.	Petroglyphs	2,000 m^2/rock art/1	Prehistoric/unknown
JM129 (5BN250)	Sec. 30, T23S, R50W 3870 ft.	Type 6.2 Base camp	22,500 m^2/lithics/2	Prehistoric/unknown

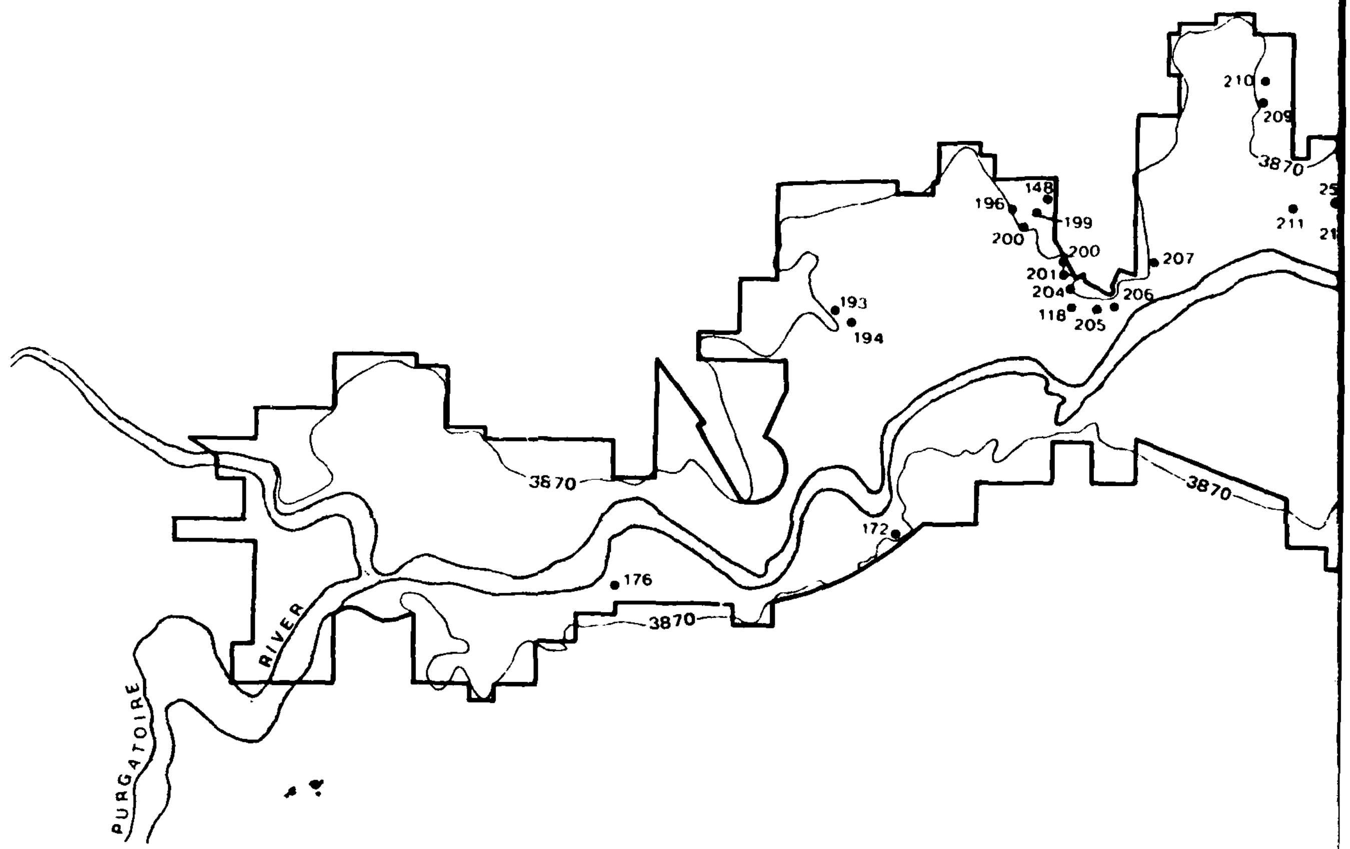
Table 5.1 - continued

Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM130 (5BN008)	Sec. 30, T23S, R50W 3870 ft.	Type 6.2 Base camp	15,456 m^2/8 hearths, scattered hearthstones/4	Prehistoric/unknown
JM131 (5BN251)	Sec. 30, T23S, R50W 3875 ft.	Type 6.2 Base camp/ ranch related	64,000 m^2/scattered hearthstones, structure/2	Prehistoric/unknown Euro-American/unknown
JM132 (5BN252)	Sec. 19, T23S, R50W 3865 ft.	Type 6.2 Base camp	38,640 m^2/12 hearths, scattered hearthstones, rock shelter/7	Post-Woodland/A.D. 1000-1700
JM133 (5BN254)	Sec. 19, T23S, R50W 3870 ft.	Type 7.1 Base camp	7,000 m^2/24 hearths/5	Prehistoric/unknown
JM134 (5BN254)	Sec. 20, T23S, R50W 3855 ft.	Type 7.2 Base camp	30,000 m^2/3 hearths, scattered hearthstones/8	Middle Archaic-Plains Woodland; Woodland-Dismal River/1000 B.C.-A.D. 250-1700
JM151 (5BN255)	Sec. 33, T22S, R50W 3890 ft.	Type 2.0 Hunting camp	1,536 m^2/hearth, scattered hearthstones, rock cairn, stone circle/6	Prehistoric/unknown
JM152 (5BN256) Lund Homestead	Sec. 29, T22S, R50W 3858 ft.	Farmstead	1,728 m^2/foundation/NA	Euro-American/1889-1940
JM153 (5BN257) Dwyer Homestead	Sec. 30, T22S, R50W 3865 ft.	Type 1.4 Hunting camp/ Farmstead	3,360 m^2/cistern, historic refuse, lithics/NA	Prehistoric/unknown Euro-American/1892-1900
JM154 (5BN258)	Sec. 31, T22S, R50W 3865 ft.	Type 2.0 Hunting camp	4,608 m^2/lithics/2	Prehistoric/unknown

Table 5.1 - continued

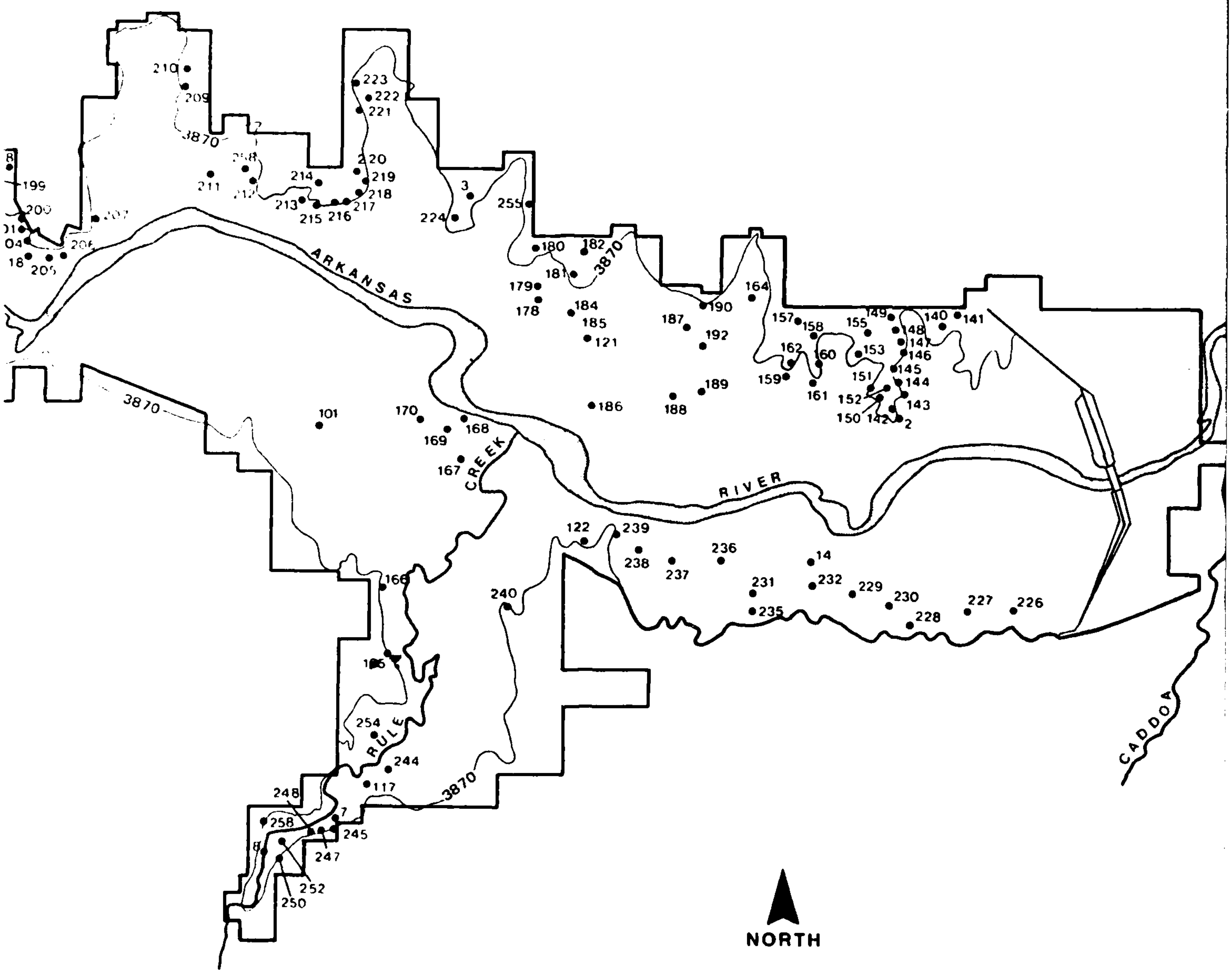
Property Name	Location/Elevation	Classification	Description (Size)(Features)/Clusters)	Cultural Affiliation (Component)/(Age)
JM155 (5BN259) Beebe Homestead	Sec. 31, T22S, R50W 3865 ft.	Farmstead/ Isolated find	288 m^2/historic refuse/lithics/2	Prehistoric/unknown Euro-American/1890-1940

FIGU
PREHISTORIC S
JOHN MARTIN RES

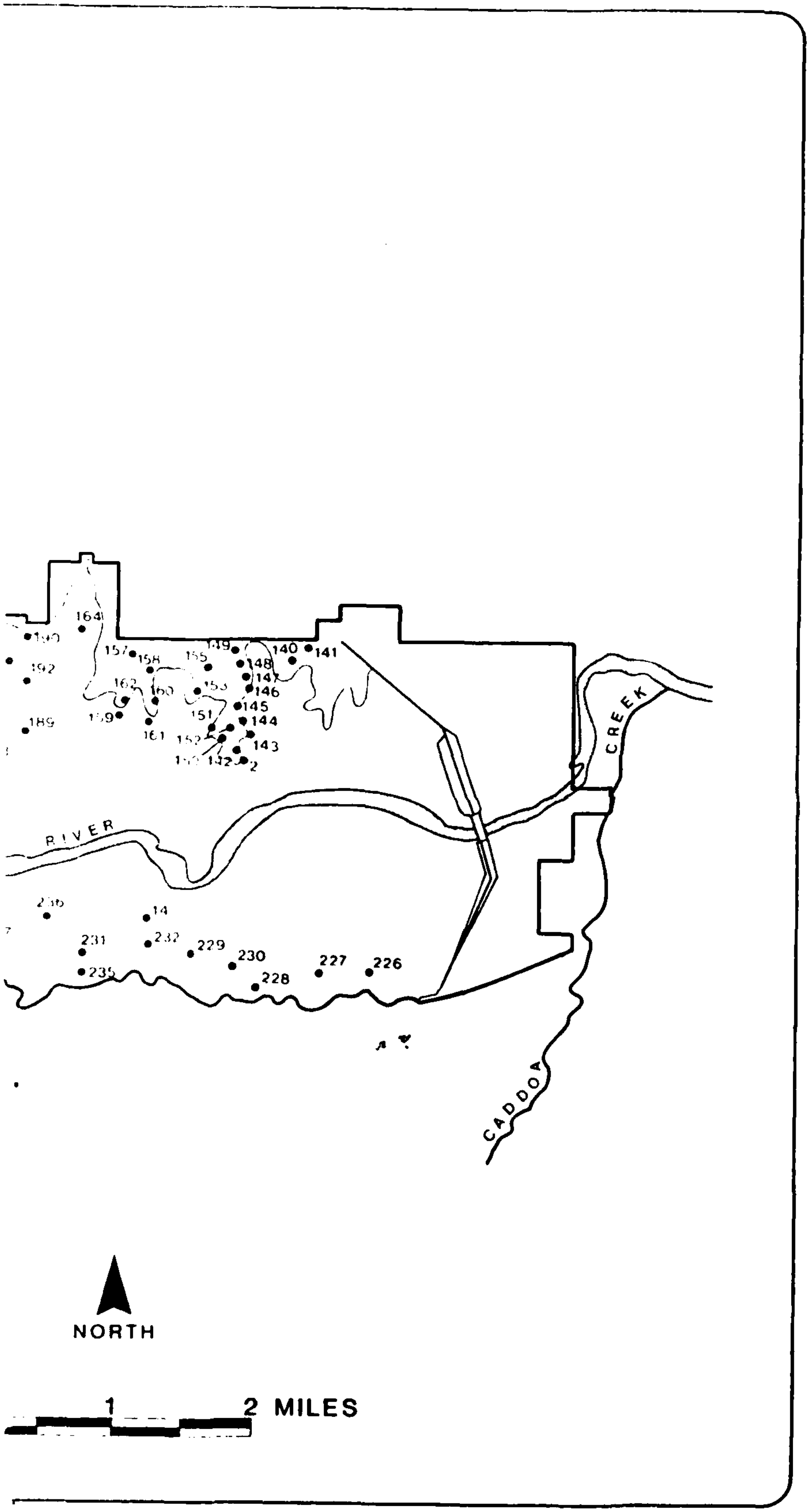


Study Area Boundary
Top of Flood Control Pool ~3870~
Prehistoric Site Locations •
(Smithsonian numbers with 5BN prefix)

FIGURE 5.1
PREHISTORIC SITE LOCATIONS
OHN MARTIN RESERVOIR PROJECT



2


164
157
140
141
148
147
146
145
144
143
151
189
161
142
RIVER
CREEK
CADDOA
231
229
230
227
226
228
NORTH
1
2 MILES

residual summer-time pool, and marshlands, were marked accurately on the USGS 7.5 minute quadrangles (Section 2.1).

Our proposal estimates for field-inventory coverage were that a single three-person crew would be able to average 60 acres/day or 347 person/days to complete the planned universe. Three crews working independently should be able to complete the job in 30 working days. This estimate was enlarged to 40 days (8 work weeks) to account for unpredictable delays, including bad weather, illness, and vehicle breakdown. In fact, 550 person days were expended over 11 weeks in accomplishing the survey and test excavations.

5.1.2 SITE LOCATION

The location of each prehistoric site and isolated artifact find (IF) was accurately plotted on applicable USGS,7.5 minute quadrangle maps and aerial photographs supplied by the COE. Sites were recorded by Legal Description and Universal Transverse Mercateur (UTM) coordinates for relocation purposes. Site locations were further recorded by Brunton compass azimuth readings and also plotted on a project map supplied by the COE.

Sites on COE fee lands were inconspicuously marked by an 18-inch rebar driven into the ground with only a few inches visible at the surface. Site numbers were permanently attached to the rebars, out of view.

5.1.3 RECORDATION

Sites and intrasite features were photographed and described by areal extent, artifact types and quantities represented, depth of deposit, cultural affiliation, physical condition, and environmental setting. Each site and isolated artifact find was fully recorded on Colorado Site Inventory forms, photographed for future identification, and evaluated for potential nomination to the National Register of Historic Places (NRHP) (Table 5.1). A scattergram map was prepared for each site and attached to the site form (Figure 4.12). Cultural materials were described in terms of existing typologies established for southeastern Colorado as discussed in Section 4.3.3.2. Counts of artifactual material on each site were made. These were obtained by scattergram mapping in the following manner. Each artifact was located and flagged by a numbered Engineers Pin Flag. Next, a Brunton compass, mounted on a tripod, was used to take an azimuth fix on the specimen, and from this data the scattergram map was constructed. The data record has the following headings:

Artifact number
Field identified form/function type
Material
Measured angle
Measured distance in meters

In case of large archeological site numbering 100 artifact specimens or more, the site perimeter was mapped, and a block of 100 artifacts serves as a continuous sample suitable for intrasite analysis using clustering procedures and the NEAREST NEIGHBOR statistic. All smaller sites were recorded by a complete census.

5.1.4 COLLECTIONS

To minimize adverse impact on the archeological sites, we practiced a modified, no pick-up collection policy in which all artifacts other than time diagnostic specimens were field recorded without disturbance. However, the stylistically distinct projectile points, pottery, and other amateur collectors items were collected after locational provenience was recorded,, for study and Museum curation. This preferential treatment prevented loss to unauthorized collectors and vandals. All materials collected were catalogued, analyzed and curated.

5.1.5 TESTING AND NATIONAL REGISTER OF HISTORIC PLACES EVALUATION

In order to assist the COE in its Executive Order 11593 responsibilities, SAI evaluated each site according to the criteria listed in 36CFR 60.6. Archeological sites were considered significant if they have yielded or may be likely to yield information important in prehistory or history as outlined in 36CFR60.6(d). Important information is taken to mean data derived from a particular site which will contribute to the resolution of significant regional, methodological of theoretical research questions. In order to make such a judgment in the field, the sites are ranked in order of importance so as to focus on the degree of significance. (Section 11.0).

Based on this management analysis, three sites were selected for field testing: JM081, 124, and 132. The results of this work are reported here in Section 5.6.

5.1.6 SUMMARY

The field methods of the John Martin site survey are described here as a record of the manner in which the data was collected for hypotheses evaluation. Subjects reviewed include: 1) the coverage procedures of the field crews, 2) the manner in which site locational data was recorded, 3) piece plotting of onsite artifacts, 4) the modified, no-pickup collection policy, and 5) the criteria for NRHP testing.

5.2 UNIVARIATE ANALYSIS OF VARIABLES

Two SPSS programs, Frequencies and Condescriptive, are employed to run univariate analysis on 50 of the numbered variables (VAR 8-28, 31-42, 44-60). These canned programs, which have been described in Section 4.3.3.3 analyze the frequency distributions of each variable for measures of central tendency and dispersion about the norm. The Frequencies program is employed to deal with ordinal and nominally coded data, while the Condescriptive program handles continuous measurements on an interval scale. The resulting descriptive statistics provide a picture of the normality of the frequency distribution and a characterization of the population of observations comprising that variable (Tables 5.2 and 5.3).

5.2.1 RANGE SITE TYPE (VAR8)

Nominal Variable 8 was coded with nine values. Each of these range site types have been described in Sections 3.1.4 and 3.2.1. Of 99 sites coded to range site type, the largest number were found in Range Types 64 (34.3%) and 6 (30.3%) (Table 5.2). In decreasing frequency, the other occurrences are: Range Site Types 19 (7.1%), 100 (6.1%), 22 (2.0%), and 26, 31, and 35 (1.0%) each.

5.2.2 SLOPE AT SITE IN PERCENTAGE GRADE (VAR9)

Onsite interval measurements of slope averaged 5.9% grade. The smallest recorded slope is 0.2 while the largest is 50.0. The standard deviation for the frequency distribution is 9.8 based on a sample size of 93 sites. Measures of kurtosis and skewness indicate that the frequency distribution is peaked (11.9) and left shifted (3.4).

5.2.3 SURROUNDING SLOPE IN PERCENTAGE GRADE (VAR10)

Offsite interval measurement of slope averaged 9.0% grade. The smallest slope value is 0.5, while the largest is 99.0. The standard deviation on 99 site measurements is 13.3. The frequency distribution is very peaked with a kurtosis value of 23.2, while the distribution is left shifted as measured by a skewness value of

TABLE 5.2
OUTPUT FROM PROGRAM FREQUENCIES FOR NOMINALLY CODED VARIABLES

VAR8 RANGE SITE TYPE

Code	Absolute Freq.	Relative Freq. (Pct)
6.	30	30.3
19.	7	7.1
22.	2	2.0
26.	1	1.0
31.	1	1.0
35.	1	1.0
53.	17	17.2
64.	34	34.3
100.	6	6.1
TOTAL	99	100.0

VAR21 BISON RATING

Code	Absolute Freq.	Relative Freq. (Pct.)
2.	36	36.4
3.	8	8.1
0	55	55.6
TOTAL	99	100.0

VAR22 ANTELOPE RATING

Code	Absolute Freq.	Relative Freq. (Pct.)
1.	18	18.2
2.	40	40.4
3.	41	41.4
TOTAL	99	100.0

VAR23 DEER RATING

Code	Absolute Freq.	Relative Freq. (Pct)
1.	38	38.4
2.	9	9.1
3.	19	19.2
0	33	33.3
TOTAL	99	100.00

VAR24 JACKRABBIT RATING

Code	Absolute Freq.	Relative Freq. (Pct.)
2.	21	21.2
3.	78	78.8
TOTAL	99	100.0

VAR25 COTTONTAIL RATING

Code	Absolute Freq.	Relative Freq. (Pct).
1.	34	34.3
2.	1	1.0
3.	64	64.6
TOTAL	99	100.0

VAR26 ELK RATING

Code	Absolute Freq.	Relative Freq. (Pct.)
2.	1	1.0
0	98	99.0
TOTAL	99	100.0

VAR27 UPLAND GAME BIRD RATING

Code	Absolute Freq.	Relative Freq. (Pct.)
2.	29	29.3
3.	37	37.4
0	33	33.3
TOTAL	99	100.0

VAR28 WATERFOWL RATING

Code	Absolute Freq.	Relative Freq. (Pct)
2.	1	1.0
0	98	99.0
TOTAL	99	100.0

TABLE 5.3
LIST OF UNIVARIATE STATISTICS FOR TOOL TYPE PERCENTAGES OUTPUT BY SPSS PROGRAM CONDESCRIPTIVE

VARIABLE VAR 38 CHOPPER PERCENTAGE

Mean	.064	Standard Error	.005	Standard Deviation	.041
Variance	.002	Kurtosis	.093	Skewness	.771
Minimum	.010	Maximum	.170	Sum	3.750
C.V. Pct.	63.726	.95 C.I.	.053	TO	.074
Valid Cases	59	Missing Cases	40		

VARIABLE VAR 39 HAMMER PERCENTAGE

Mean	.042	Standard Error	.005	Standard Deviation	.034
Variance	.001	Kurtosis	.429	Skewness	1.048
Minimum	.010	Maximum	.140	Sum	2.000
C.V. Pct.	80.948	.95 C.I.	.032	TO	.051
Valid Cases	48	Missing Cases	51		

VARIABLE VAR 40 SCRAPER PERCENTAGE

Mean	.093	Standard Error	.009	Standard Deviation	.080
Variance	.006	Kurtosis	3.430	Skewness	1.652
Minimum	.010	Maximum	.410	Sum	7.470
C.V. Pct.	65.861	.95 C.I.	.076	TO	.111
Valid Cases	80	Missing Cases	19		

VARIABLE VAR 41 BIFACE PERCENTAGE

Mean	.039	Standard Error	.006	Standard Deviation	.038
Variance	.001	Kurtosis	1.631	Skewness	1.581
Minimum	.010	Maximum	.150	Sum	1.810
C.V. Pct.	99.246	.95 C.I.	.027	TO	.050
Valid Cases	47	Missing Cases	52		

VARIABLE VAR 42 PROJECTILE POINT PERCENTAGE

Mean	.025	Standard Error	.005	Standard Deviation	.016
Variance	.000	Kurtosis	1.619	Skewness	1.265
Minimum	.010	Maximum	.060	Sum	.250
C.V. Pct	63.246	.95 C.I.	.014	TO	.036
Valid Cases	10	Missing Cases	89		

Table 5.3 - Continued

VARIABLE VAR 44 GRAVER PERCENTAGE

Mean	.021	Standard Error	.004	Standard Deviation	.014
Variance	.000	Kurtosis	.585	Skewness	1.214
Minimum	.010	Maximum	.050	Sum	.230
C.V. Pct.	65.766	.95 C.I.	.012	TO	.030
Valid Cases	11	Missing Cases	88		

VARIABLE VAR 45 UTILIZED FLAKE PERCENTAGE

Mean	.263	Standard Error	.019	Standard Deviation	.175
Variance	.031	Kurtosis	-1.087	Skewness	.135
Minimum	.010	Maximum	.680	Sum	22.660
C.V. Pct.	66.578	.95 C.I.	.226	TO	.301
Valid Cases	86	Missing Cases	13		

VARIABLE VAR 46 FLAKE KNIFE PERCENTAGE

Mean	.041	Standard Error	.012	Standard Deviation	.065
Variance	.004	Kurtosis	22.347	Skewness	4.510
Minimum	.010	Maximum	.360	Sum	1.180
C.V. Pct.	159.939	.95 C.I.	.016	TO	.065
Valid Cases	29	Missing Cases	70		

VARIABLE VAR 47 METATE PERCENTAGE

Mean	.144	Standard Error	.032	Standard Deviation	.165
Variance	.027	Kurtosis	9.719	Skewness	2.688
Minimum	.010	Maximum	.810	Sum	3.880
C.V. Pct.	114.948	.95 C.I.	.078	TO	.209
Valid Cases	27	Missing Cases	72		

VARIABLE VAR 48 MANO PERCENTAGE

Mean	.055	Standard Error	.009	Standard Deviation	.049
Variance	.002	Kurtosis	3.759	Skewness	1.841
Minimum	.010	Maximum	.210	Sum	1.490
C,V. Pct.	88.968	.95 C.I.	.036	TO	.075
Valid Cases	27	Missing Cases	72		

Table 5.3 - Continued

VARIABLE VAR 49 CORE PERCENTAGE

Mean	.167	Standard Error	.011	Standard Deviation	.110
Variance	.012	Kurtosis	-.183	Skewness	.756
Minimum	.010	Maximum	.460	Sum	15.820
C.V. Pct.	66.170	.95 C.I.	.144	TO	.189
Valid Cases	95	Missing Cases	4		

VARIABLE VAR 50 PRIMARY FLAKE PERCENTAGE

Mean	.108	Standard Error	.010	Standard Deviation	.084
Variance	.007	Kurtosis	2.171	Skewness	1.322
Minimum	.010	Maximum	.440	Sum	7,900
C.V. Pct.	77.271	.95 C.I.	.089	TO	.128
Valid Cases	73	Missing Cases	26		

VARIABLE VAR 51 SECONDARY FLAKE PERCENTAGE

Mean	.128	Standard Error	.010	Standard Deviation	.091
Variance	.008	Kurtosis	1.285	Skewness	1.163
Minimum	.020	Maximum	.430	Sum	10.020
C.V. Pct.	70.615	.95 C.I.	.108	TO	.149
Valid Cases	78	Missing Cases	21		

VARIABLE VAR 52 TERTIARY FLAKE PERCENTAGE

Mean	.101	Standard Error	.011	Standard Deviation	.104
Variance	.011	Kurtosis	4.948	Skewness	2.128
Minimum	.010	Maximum	.540	Sum	8.300
C.V. Pct.	102.599	.95 C.I.	.078	TO	.124
Valid Cases	82	Missing Cases	17		

VARIABLE VAR 53 BIFACE THINNING FLAKE PERCENTAGE

Mean	.035	Standard Error	.010	Standard Deviation	.038
Variance	.001	Kurtosis	4.865	Skewness	2.141
Minimum	.010	Maximum	.140	Sum	.450
C.V. Pct.	109.127	.95 C.I.	.012	TO	.057
Valid Cases	13	Missing Cases	86		

Table 5.3 - Continued

VARIABLE VAR 54 REJUVENATION FLAKE PERCENTAGE

Mean	.042	Standard Error	.029	Standard Deviation	.059
Variance	.003	Kurtosis	3.864	Skewness	1.962
Minimum	.010	Maximum	.130	Sum	.170
C.V. Pct.	137.702	.95 C.I.	-.051	TO	.136
Valid Cases	4	Missing Cases	95		

VARIABLE VAR 55 UNCLASSIFIED FLAKE PERCENTAGE

Mean	.040	Standard Error	.015	Standard Deviation	.069
Variance	.005	Kurtosis	17.799	Skewness	4.117
Minimum	.010	Maximum	.330	Sum	.830
C.V. Pct.	174.464	.95 C.I.	.008	TO	.071
Valid Cases	21	Missing Cases	78		

VARIABLE VAR 56 MISCELLANEOUS CORE TOOL PERCENTAGE

Mean	.092	Standard Error	.013	Standard Deviation	.080
Variance	.006	Kurtosis	.039	Skewness	.918
Minimum	.010	Maximum	.310	Sum	3.690
C.V. Pct.	86.807	.95 C.I.	.067	TO	.118
Valid Cases	40	Missing Cases	59		

VARIABLE VAR 57 BIFACE KNIFE PERCENTAGE

Mean	.026	Standard Error	.006	Standard Deviation	.013
Variance	.000	Kurtosis	-2.407	Skewness	.166
Minimum	.010	Maximum	.040	Sum	.130
C.V. Pct.	51.602	.95 C.I.	.009	TO	.043
Valid Cases	5	Missing	94		

VARIABLE VAR 58 UNCLASSIFIED GROUND STONE TOOL PERCENTAGE

Mean	.065	Standard Error	.014	Standard Deviation	.066
Variance	.004	Kurtosis	3.621	Skewness	1.885
Minimum	.010	Maximum	.270	Sum	1.430
C.V. Pct.	100.800	.95 C.I.	.036	TO	.094
Valid Cases	22	Missing Cases	77		

Table 5.3 - Continued

VARIABLE VAR 59 MANUPORT PERCENTAGE

Mean	.127	Standard Error	.087	Standard Deviation	.151
Variance	.023	Kurtosis	0	Skewness	1.597
Minimum	.020	Maximum	.300	Sum	.380
C.V. Pct.	119.556	.95 C.I.	-.250	TO	.503
Valid Cases	3	Missing Cases	96		

VARIABLE VAR 60 POTSHERD PERCENTAGE

Mean	.035	Standard Error	.015	Standard Deviation	.021
Variance	.000	Kurtosis	0	Skewness	0
Minimum	.020	Maximum	.050	Sum	.070
C.V. Pct.	60.609	.95 C.I.	-.156	TO	.226
Valid Cases	2	Missing Cases	97		

4.3. In conclusion, slope is steeper and more variable just offsite than it is onsite.

5.2.4 ASPECT IN DEGREES (VAR11)

The mean heading of archeological sites is 158.0 degrees or approximately SSE suggesting a winter occupation when site selection would favor a southern exposure to capitalize on the warming effect of the sun. However, the range of aspect from 5.0 to 360 degrees indicates considerable variability in heading choices. But a general southern and eastern preference is again indicated by the standard deviation of 94.8 degrees, a dispersion ranging from ENE to WSW in heading. The very low kurtosis (-1.0) and skewness (0.2) values indicate a close approximation to a normal curve. Interval measurements for these statistics were taken from 96 archeological sites.

5.2.5 SITE ELEVATION IN METERS (VAR12)

The mean elevation of archeological sites is 1176.4 m with a range (1122.9 to 1193.3) of 70.4 m. These figures reflect the low relief of the central High Plains and the shallow depth that the Arkansas River has cut below the general prairie surface. The dispersion of values, as measured by the standard deviation, is only 7.8 m run on 99 site cases. The distribution tends to be peaked with a kurtosis of 21.8 and right shifted as expressed by the skewness value of -3.2. This distribution is definitely affected by the existing reservoir lake which prevented recording more sites at lower elevations near the river bottom.

5.2.6 DISTANCE TO NEAREST INTERMITTENT DRAINAGE (VAR13)

The mean distance measured straight line from archeological site to intermittent drainage is 441.1 m. The minimum value is 26.0 m and the maximum is 4826.0 m; a very wide range which is also reflected in a large standard deviation of 757.3 m. Kurtosis is 23.7 indicating a high-peaked distribution, while the positive skewness is 4.6 m suggesting a clustering of values to the left of the mean. These statistics were run on 98 archeological sites.

5.2.7 HEIGHT ABOVE INTERMITTENT DRAINAGE (VAR14)

The height of archeological site above the closest intermittent drainage averages 7.4 m. But less variability is seen in the standard deviation value of 5.7 m measured on 96 archeological sites. The distribution closely approximates a normal curve with kurtosis value of 1.3 and a skewness of 1.2.

5.2.8 DISTANCE TO ARKANSAS RIVER (VAR15)

The straight line distance from archeological site to the Arkansas River averages 932.3 m. The minimum distance is 30.0, while the maximum is 9144.0 m. Variability within the distribution is considerable as expressed by a standard deviation of 1030.3 m measured on 98 archeological sites. The distribution departs significantly from a normal curve with a peaked kurtosis of 41.5 and a left skewness of 5.4 m. Like site elevation, this distance measure is definitely affected by the existing reservoir lake, which prevented recording more archeological sites closer to the Arkansas main channel.

5.2.9 HEIGHT ABOVE ARKANSAS (VAR16)

Archeological sites tend to cluster towards lower elevations just above the Arkansas River where permanent water is available. On the average, they are only 18.4 m above the river. This tendency is supported by the minimum

(1.5 m) and maximum (36.3 m) values and even more so by the low standard deviation of 8.9 m. The frequency curve is a good approximation to a normal distribution with kurtosis of -0.7 and skewness value of 0.1 m run on 99 archeological sites.

5.2.10 DISTANCE TO EDGE OF RANGE SITE (VAR17)

This variable was designed to measure the centrality of site situation. Large distances indicate a site choice for interior range site locations, while small figures indicate a preference for the ecotonal advantages of more resources. The mean figure of 80.7 m suggests that sites did tend to favor the habitat boundaries where more exploitable resources are to be found. However, the wide range of choices from a minimum distance of 3.0 m to a maximum of 680 m shows that sites are distributed widely along the centrality axis. This dispersion is repeated in the standard deviation measure with a value of 141.7 m measured on 94 archeological sites. The frequency distribution is somewhat peaked with a kurtosis of 7.6 and a left skewness of 2.9.

5.2.11 PERCENTAGE OF DOMINANT RANGE SITES IN A ONE-KILOMETER CIRCLE (VAR18)

Variable 18 is another means of measuring the locational choice of homogeneous versus heterogeneous site habitats. The mean percentage of 99 archeological sites is 87.0% dominance by the most common range site; a figure which indicates that the preference was for single habitats rather than multiple within a 1-km circle. The minimum percentage is 48.3, while the maximum is 99.9; a scale from very heterogeneous to very homogeneous surroundings. However, the variability expressed by the Standard Deviation of 13.6% indicates a strong preference for the homogeneous choice. The frequency distribution of values is a close approximation of a normal curve; kurtosis being -0.3 and skewness -0.9 percent.

5.2.12 NUMBER OF RANGE SITES IN A ONE-KILOMETER CIRCLE (VAR 19)

The mean number of range sites within a 1-km circle of 99 archeological sites is 2.0. This average is close to the midpoint of the minimum value of 1.0 range sites and the high of 4.0 range sites. The standard deviation of 0.7 shows a low dispersion with most sites favoring the choice of location between 2 to 3 range sites. The frequency distribution is a close approximation to a normal curve with kurtosis of 0.4 and skewness of 0.5.

5.2.13 STANDING CROP YIELD IN POUNDS PER ACRE (VAR20)

Data from the range site location of 99 archeological sites shows an average standing-crop productivity of 86.6 pounds per acre. It is hypothesized that sites involved in mineral exploitation would favor the range sites with a low productivity of 80.0 pounds per acre, while the plant processing stations will be those favoring habitats of high-standing crop productivity with values of 250 pounds per acre. The standard deviation of 22.5 shows a variability towards the low end of the range suggesting a disfavoring of the more productive range sites. The frequency distribution is very peaked with kurtosis of 31.1 and left skewed with a value of 5.1.

5.2.14 BISON RATING (VAR21)

Ordinally coded bison ratings were taken from the SCS range site data as a means of determining which archeological sites favored habitats potentially containing big game. Of the

99 archeological sites so coded, 36.4% favored habitats with a moderate (Code 2) forage potential for bison, while 8.1% favored a high (Code 3) bison rating. No archeological sites were found in range site habitats with low (Code 1) bison potential, and 55.6 percent occurred in habitats where a bison rating was not applicable (Code 0). From these Frequencies program distributions, it appears that bison hunting was not the most prominent hunting strategy followed by these prehistoric peoples of the John Martin area (Table 5.2). Empirical support for this hypothesis of low bison hunting activity is the fact that the John Martin sites are mostly post-Archaic in age, hence the bulk of the occupation was during Dillehay's (1974) Bison Absence Period III (Figure 3.1).

5.2.15 ANTELOPE RATING (VAR22)

Analysis of 99 archeological sites shows a high preference for range sites with a strong forage potential for antelope. In declining frequencies, these site preferences are high antelope potential (41.4% of the sites), moderate potential (40.4% sites), and low potential (18.2% sites). This distribution implies that the prehistoric hunters were favoring locations with a high potential for antelope; a hunting strategy which can be examined by the excavation recovery of antelope bone (Table 5.2).

5.2.16 DEER RATING (VAR23)

Archeological sites favor range sites with deer potential according to the following distribution: high preference (19.2% of the sites), moderate preference (9.2% sites), low preference (38.4% sites), and not applicable (33.3% sites) (Table 5.2). Therefore, analysis of 99 archeological sites strongly suggests a disfavoring of locations with much deer potential. However, it must be kept in mind that deer are browsers and would themselves favor riparian habitats on the Arkansas River floodplain. Since these floodplain locations are now covered with the reservoir lake, our survey records will be biased against such data so that the true picture of deer hunting potential is not revealed by these statistics.

5.2.17 JACKRABBIT RATING (VAR24)

Hunting and trapping of jackrabbit was probably high in the prehistoric past as indicated by the archeological site counts which favor range sites with high (78.8% of sites) and moderate (21.2% sites) rabbit ratings. Thus Frequencies analysis of 99 archeological sites supports a hypothesis of small-game harvest (Table 5.2).

5.2.18 COTTONTAIL RATING (VAR25)

Additional support for the hypothesis of rabbit hunting is generated by analysis of 99 archeological sites which show a preference for range sites with cottontail potential. The archeological site preference by cottontail rating are high preference (64.6% of the sites), moderate preference (1.0% sites), and low preference (34.3% sites [Table 5.2]).

5.2.19 ELK RATING (VAR26)

Archeological site counts by SCS range site types demonstrate a strong disfavoring of this hunting potential. Of 99 archeological sites coded, 99.0% occur on range sites where elk ratings are not applicable. One percent occur on a range site with moderate elk potential. However, these trends are of limited validity when it is remembered that elk feed by browsing. On the High Plains, this would mean that they would inhabit the riparian riverside cover now covered by the reservoir lake. Thus, our archeological survey is strongly biased against the recovery of the pertinent data (Table 5.2).

5.2.20 UPLAND GAME BIRD RATING (VAR27)

Ninety-nine ordinally coded archeological sites were analyzed for Upland Game Bird potential by SCS range site type. The results show an even distribution of site preferences across each bird habitat in the series: high preference (37.4% of the sites), moderate preference (29.3% sites), low preference (no sites), and not applicable (33.3% sites). From these statistics, it is hypothesized that prehistoric hunters chose site locations near game-bird feeding areas where hunting and trapping potentials were high (Table 5.2).

5.2.21 WATERFOWL RATING (VAR28)

Ordinal coding of 99 archeological sites shows 1.0% favoring a SCS range site with moderate waterfowl potential and 99.0% occuring in range sites with no waterfowl potential. But as with deer and elk, the reservoir lake prevented recording many archeological sites from along the Arkansas River channel, and therefore, our data is biased against waterfowl potentials (Table 5.2).

5.2.22 NUMBER OF HEARTHS (VAR31)

Of the 99 archeological sites analyzed statistically, only 22.2 percent had fire hearths on them. On the average these had 3.5 hearths. Sites with hearths varied from a low of one to a maximum of 24. The dispersion about the mean is measured by the standard deviation, a value of 5.2 hearths. The frequency distribution is peaked with a kurtosis value of 12.7 and a left-shifted skewness of 3.4. Sites with more fire hearths are likely to have served as base camps, while those with lower numbers were probably overnight stops and/or collecting and hunting stations. Seasonal reoccupation would also account for more hearths on a site.

5.2.23 SITE TYPE (VAR32)

The NTSYS classification of seven numbered site types was not available for Frequencies analysis at the time this latter program was run on other nominal data. For this reason, the counts and percentage calculations were done by hand. Of the 99 prehistoric sites composing the computer file, one could not be classified by NTSYS analysis due to a lack of portable artifacts. The remaining 98 sites, as tabulated from dendrogram, Figure 6.3, show the following site type distribution:

Type	1	= 35 sites (35.71%)
	1.1	= 4
	1.2	= 5
	1.3	= 10
	1.4	= 11
	1.5	= 5
Type	2	= 10 sites (10.20%)
Type	3	= 4 sites (4.08%)
Type	4	= 5 sites (5.10%)
Type	5	= 20 sites (20.41%)
	5.1	= 5
	5.2	= 12
	5.3	= 5
Type	6	= 14 sites (14.29%)
	6.0	= 2
	6.1	= 3
	6.2	= 9
Type	7	= 10 sites (10.20%)
	7.0	= 1
	7.1	= 5
	7.2	= 4
TOTAL		= 98 sites (99.98%)

This distribution shows that one-quarter of the sites are base camps (Types 6 and 7), while the remaining three-quarters are special-activity sites (Types 1-5). A more complete identification of each of these functional site types is provided in Section 6.1.

5.2.24 SITE SIZE (VAR33)

Estimates of site size were made by multiplying the length by the width to produce an area in square meters. Of 99 archeological sites, the mean size is 11768.2 m^2. The smallest size site is 25.0 sq. m, while the largest is 99999.9 sq. m. The standard deviation of this distribution is 17778.2 m^2, a figure which expresses considerable dispersion about the mean. The distribution is a reasonably close fit to a normal curve with kurtosis of 9.3 and left shifted skewness of 2.9.

5.2.25 NUMBER OF ARTIFACT TYPES (VAR34)

Information diversity is measured by a simple count of the number of artifact types. It is hypothesized that base camps contain more variety of tools while special-activity sites have far fewer. On the average, the 99 archeological sites of this statistical study had 8.1 artifact types. The type frequency distribution is a good approximation to a normal curve with a kurtosis of 0.6 and a skewness of 0.03.

5.2.26 ARTIFACT DENSITY (VAR35)

Density or number of artifacts per square meter is a measure of occupational intensity, degree of artifact structuring, and relative size. In general, base camps should exhibit higher artifact densities than temporary camps.

Of the 98 archeological sites analyzed for tool density, the average figure was 0.019 specimen/m^2; an expression of the fact that these lithic scatters are made up of a thin spread of artifacts. The minimum figure is 0.001 and maximum density is 0.12 artifacts/m^2. These values are tightly clustered about the mean as measured by the standard deviation of 0.022 artifacts/m^2. The fit to a normal curve is expressed by the kurtosis of 3.9 with skewness of 1.9.

5.2.27 SITE DENSITY IN ONE-KILOMETER CIRCLE (VAR36)

The mean density of sites found within the 1-km circle is 37.85. The smallest number is 10.0 and the maximum 105.0 with a standard deviation of 21.09. The very small kurtosis of 0.246 and skewness of 0.740 indicates a close approximation to a normal curve.

5.2.28 SITE DENSITY IN THREE-KILOMETER CIRCLE (VAR37)

The mean site density within a three kilometer circle is 14.21; a much smaller value than for the 1-km circle thereby indicating the looseness of site packing. The minimum density value is 3.0 and maximum is 28.0. The standard deviation of this distribution is 6.419. The small kurtosis (-0.389) and skewness (0.219) indicate a nearly normal distribution.

5.2.29 TOOL AND FLAKE TYPE PERCENTAGES (VAR38-42, VAR44-60)

Univariate statistics for tool and flake types are listed on Table 5.3. Critical values are mean, minimum, maximum, standard deviation, kurtosis, and skewness. The number of valid cases (sites) is shown at the bottom of each variable list. Variable 43 is an unassigned category.

5.2.30 SUMMARY

This section has reviewed the quantified observations (50 variables) made on a computer file of 99 out of 111 archeological sites. Descriptive statistics are presented based on two SPSS subprograms: Frequencies and Condescriptive. This information provides an introduction

to the data base to be used in evaluating the research hypotheses.

5.3 COLLECTED ARTIFACT DESCRIPTIONS

To minimize adverse impact on the archeological sites, a "modified, no pickup" collection policy was practiced in the field. Some artifacts other than time diagnostic specimens were field recorded without disturbance. However, the stylistically distinct projectile points, pottery, and other "collectors" items such as bifacial and unifacial tools, manos and metates were collected after locational provenience was recorded. This preferential treatment was employed to prevent loss to unauthorized collectors and vandals (Section 5.1.3). After analysis, all collected artifacts will be curated at the Department of Anthropology, University of Denver.

5.3.1 LABORATORY PROCEDURES

All collected prehistoric artifacts were processed through the Science Applications, Inc. laboratory in Boulder, Colorado. Previous to being brought into the Boulder office, the collected artifacts were placed in paper bags, either by individual bag per artifact, or one bag per site collection. Each bag was labeled 1) Project Name, 2) Temporary J.M. Site Number, 3) Artifact Provenience, 4) Date of Collection, and 5) Initials of the Collector.

After the artifacts were brought into the Boulder laboratory, they were washed, dried, and briefly described on a cataloguing sheet. Individual catalogue numbers were assigned to each collected specimen (not to be confused with the field mapping number). Catalogue numbers were assigned beginning with number one and numbered consecutively for each site. Example: JM035-1, JM035-2, JM060-1, JM060-2, JM100-1, and so on.

If there were several fragments of one identifiable artifact, all pieces were assigned the same number with consecutive alphabetical suffixes. Example: JM059-1A, JM059-1B, JM059-1C.

The mapping number assigned in the field (number found on the site forms and mapping sheets) is designated in parenthesis immediately following the catalogue number. Example: JM060-1(12).

Each artifact was labeled in black waterproof ink with the site number and the catalogue number. A file card containing: 1) project name, 2) site number, 3) temporary site number, 4) catalogue number and field number, 5) provenience, 6) initials of the cataloguer, 7) description and 8) date catalogued, was placed with each artifact. Each artifact and file card was placed in an individual plastic bag for curation. This was all done to insure maintenance of provenience.

During the cataloguing, all of the collected artifacts were examined to determine their proper disposition. The historic artifacts, faunal remains, excavated materials, and prehistoric surface artifacts were separated and routed for specialized analysis. Only the prehistoric surface artifacts will be treated here.

5.3.1.1 CLASSIFICATION AND DESCRIPTION PROCEDURES

The entire collection was laid out, and all prehistoric materials were segregated into two groups: lithic artifacts and pottery.

The lithic artifacts were divided into three categories: projectile points, artifacts located in a cache at JM022, and all other patterned tools. Patterned tools were defined as those artifacts whose final form was the result of a definite and predetermined reduction process. Examples of these are bifaces, drills, scrapers, knives, choppers, and ground stone.

The patterned tools were then grouped into assemblages of similar attributes. A complete description was given for each individual artifact and assemblage. This description included the shape, range of length, width, thickness, weight, material type and color, and a narrative description (Figures 5.2 and 5.3).

No new labels were attached to any previously described artifact or category. Existing projectile point typologies used include the Paleo-Indian research of Wheat (1972; pers. comm. 1980), the Texas/Oklahoma point typologies of Suhm and Jelks (1962) and Bell (1958), the works of Perino (1968). The northwestern Plains sequence of Frison, Wilson and Wilson, and the research of Cynthia Irwin-Williams and Henry J. Irwin (1966) at Magic Mountain. Personal communication with John D. Gooding, Colorado State Highway Archeologist; Charles W. Wheeler, Staff Archeologist Western Cultural Resource Management; Gary L. Moore, Staff Archeologist, Science Applications, Inc.; and Frank W. Eddy, Senior Archeologist, Science Applications, Inc. also aided in the projectile-point identification.

5.3.1.2 POTTERY CLASSIFICATION PROCEDURES

Pottery was examined in groups of similar attributes. Due to the smallness of the sherd sizes and the absence of any rim specimens, the grouping was based on the type of paste and the surface treatment of specimen. Previously described ceramic types were used when possible. Comparisons with the pottery descriptions of Gunnerson (1968, 1969); Kingsley and Nowak (1980), and Shum and Jelks (1962) were used. Personal communication with Alan Kihm, Staff Paleontologist/Geologist with the Colorado State Highway Department; Priscilla Ellwood, Ceramiacist with the University of Colorado Museum; and Joe Ben Wheat, Curator of the University of Colorado Museum, also aided in the identification of the paste, surface treatment, and type identification.

The pottery groups were described by sample size, paste and method of manufacture temper, color, texture, surface finish, range of size, including length, width, thickness and weight, and, where possible, previously identified pottery type.

5.3.1.3 LABORATORY EQUIPMENT

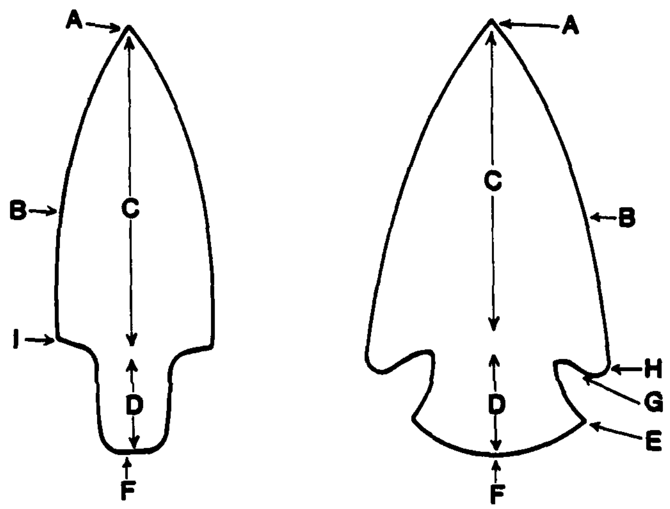
A Dial-o-Gram 2610 gram triple beam scale was used to obtain each artifact weight. Measurements were taken from an SPI sliding type 30-416 micrometer and were stated in millimeters. A microscopic analysis was conducted to determine edge attributes of all patterned tools and utilized debitage flakes. For this a 10- to 20-power binocular dissecting microscope was used. A photographic record was made of all collected material.

5.3.2 ARTIFACT ANALYSIS

To the archeolgist, a study of artifactual materials can reveal much about the human activity which occurred in a given area. Specific toll assemblages denote specific activities such as the presence of hoes and milling tools corresponding with horticultural activity, while projectile points, knives, and hide scraping tools correspond to a hunting subsistence. Artifacts such as projectile points and ceramics which do not remain static but have characteristically changed through time are also helpful in giving us relative time sequences for the areas in which they are found. Because no radiocarbon samples were obtained in conjunction with the collected artifacts no absolute dating has been possible. However, the analysis of the artifacts makes it possible to develop a relative chronology of some sites within the survey area.

In the artifact descriptions which follow, those specimens which were broken, and thus

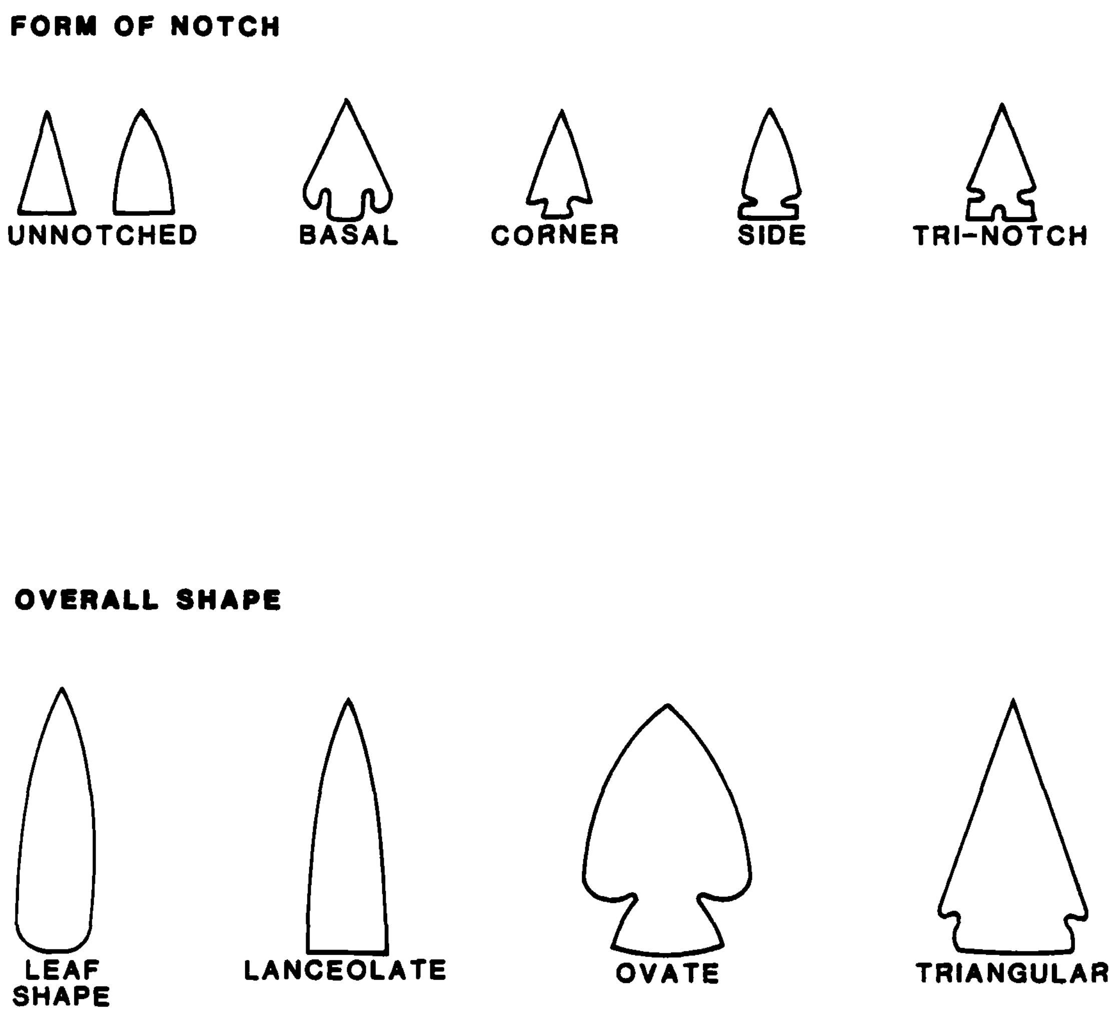
FIGURE 5.2
STANDARD PROJECTILE POINT TERMINOLOGY
JOHN MARTIN RESERVOIR PROJECT



A The Point or Tip
B The Edge
C The Face, Body or Blade
D The Stem
E The Tang
F The Base
G The Notch
H The Barb
I The Shoulder

Adapted from Perino's *Guide to the Modification of Certain American Indian Projectile Points*. Special Bulletin No. 3, Oklahoma Anthropological Society, P.I., October 1968.

FIGURE 5.3
SHAPE CLASSIFICATION OF PROJECTILE POINTS
JOHN MARTIN RESERVOIR PROJECT



are not represented by complete measurements are designated by an asterisk (*).

5.3.2.1 PROJECTILE POINTS

In the following descriptions, projectile-point measurements will be abbreviated as follows: L=total length; BW=blade width; BT=blade thickness; BL=blade length; SL=stem length; SW=stem width; and W=weight.

Untyped Dart Point (Figure 5.4A)

No. of Specimen: 1

Material: dark grey to black, fine-grained quartzite.

Measurements: Point No. JM060-1 (29)

L=25.2mm*	BW=18.6mm*	BT=5.9mm*
BL=17.2mm*	SL=8.0mm*	SW=16.0mm*
W= .3mm*		

Description: This point is only represented by base, stem, and a fragment of the body. It is unnotched; the stem is rectangular with parallel edges, base straight, shoulders very slight and sloping, stem and base edges are lightly ground, medium in cross-section. The flaking is rough to medium, irregular with three thinning failure scars exhibited on one face.

Remarks: The point has been reworked into a hafted knife and exhibits slight polishing on one lateral edge. Thus, exact point identification is unknown. This dart point is similar to the Rio Grande Point (Perino 1968:78), but the stem is shorter. It also appears to be similar to the Travis Point (Bell 1958:94). It has been suggested that the point is an Early Archaic form (Wheat 1981, pers. comm.).

Magic Mountain 3 Dart Point (Figure 5.4 B,C)

No. of Specimen: 2

Material: (1) dark grey fine-grained quartzite
(1) light grey to white fine-grained quartzite

Measurements: Point No. JM109-1(7)
JM123-1(1)

L=30.1mm	BW=15.6mm	BT=6.1mm
21.3mm*	13.5mm	5.0mm
BL=22.8mm	SL=7.3mm	SW=10.8mm
13.0mm	8.3mm	11.2mm
W=2.9g		
1.7g		

Description: The specimens are triangular to leaf-shaped in outline. One specimen has shallow side-notching. Blade edges are slightly convex to slightly recurved. Stems are expanding-contracting on one specimen and contracting- convex on the other. Bases are convex and unground. Shoulders are slight and rounded to sloping. The point is dull on one specimen and is absent on the other. Blade edges are unserrated and both specimen are medium biconvex in cross-section.

Remarks: The complete specimen has been reworked, exhibiting retard flaking on both lateral edges and the point. This possibly accounts for the very slight sloping shoulders. The point was probably utilized as a hafted knife, one lateral edge exhibits slight crushing while the other exhibits few parallel and irregular step fractures.

Comparisons: Irwin-Williams and Irwin, 1966: p. 70, Figure 20.

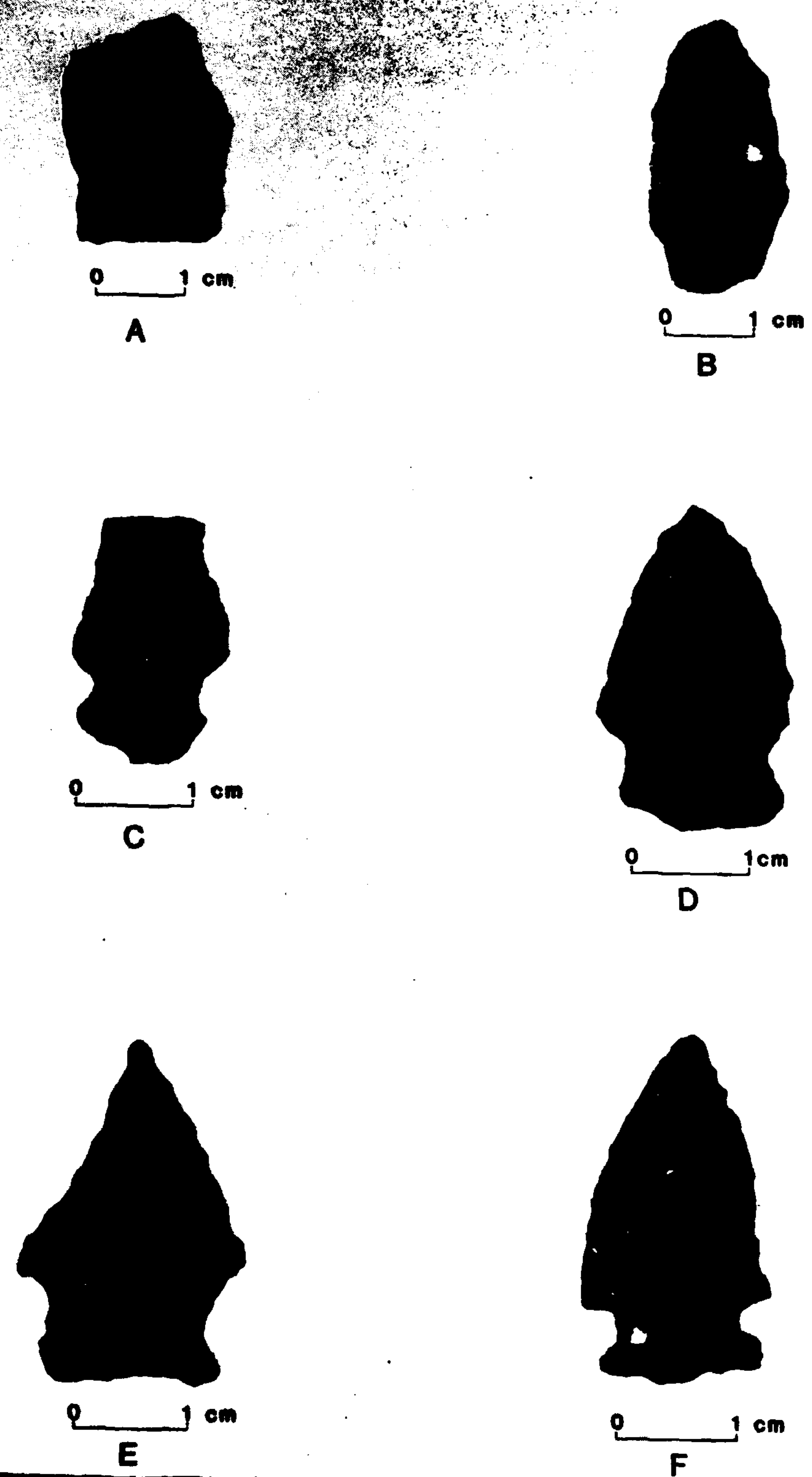
Ellis (Figure 5.4 D, E)

No. of Specimen: 2

Material: (1) Light and dark grey mottled chert
(1) pink and white mottled chert

Measurements: Point No. JM43-2(1)
IF108-1(1)

FIGURE 5.4
PROJECTILE POINTS FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT



L=27.1mm BW=11.2mm BT=4.7mm
28.7mm* 18.7mm 5.1mm
BL=18.2mm SL=8.9mm SW=13.5mm
20.0mm* 8.7mm 15.2mm
W=2.5g
2.4g

Description: These points are ovate to triangular in outline. They are shallow corner notched; blade edges slightly convex, with one edge slightly concave; stems expanding; bases straight to slightly concave; abrupt shoulders and point sharp. Stems and bases are unground and medium biconvex in cross-section. Workmanship is fine to medium parallel oblique and irregular pressure flaking.

Remarks: One specimen has possibly been retouched and utilized as a hafted drill. The lateral edges of the tip have been beveled forming a central-medial ridge. Lateral edges and medial ridges at this tip exhibit roundings and slight polishing.

Comparisons: Bell 1958: 32, PL16

Ensor (Figure 5.4, F)

No. of Specimen: 1
Material: Brown chert
Measurements: Point No. JM134-2 (100)
L=38.mm BW=20,8mm BT=6.0mm
BL=29.2mm SL=9.0mm SW=18.0mm
W=5.0g

Description: This specimen is slightly ovate to triangular in outline, side notched, slightly convex blade edge, stem greatly expanding, base irregular to convex, shoulders weakly oblique, point sharp, stem and base unground, blade slightly serrated and planoconvex in cross-section. This point was manufactured from a flake of medium thickness. The only modification exhibited is pressure retouch along all margins. One large thinning failure scar is exhibited on the dorsal face.

Comparisons: Bell 1958: 34, PL 17

Scallorn (Figure 5.5, E)

No. of Specimen: 1
Material: White chert
Measurements: Point No. JM134-1(68)
L=32.2mm BW=18.4mm BT=7.3mm
BL=28.5mm SL=8.7mm SW=12.3mm
W=4.1g

Description: Overall shape is triangular. It is corner notched, straight to slightly convex blade edges, stem is very slightly expanding to expanding, straight base, abrupt shoulder, point dull, blade edge serrated, and medium to thick biconvex in cross-section. The workmanship is fine to medium parallel oblique and irregular pressure flaking. This point exhibits numerous thinning failure scars unifacially.

Comparisons: Bell 1960: 84, PL 42

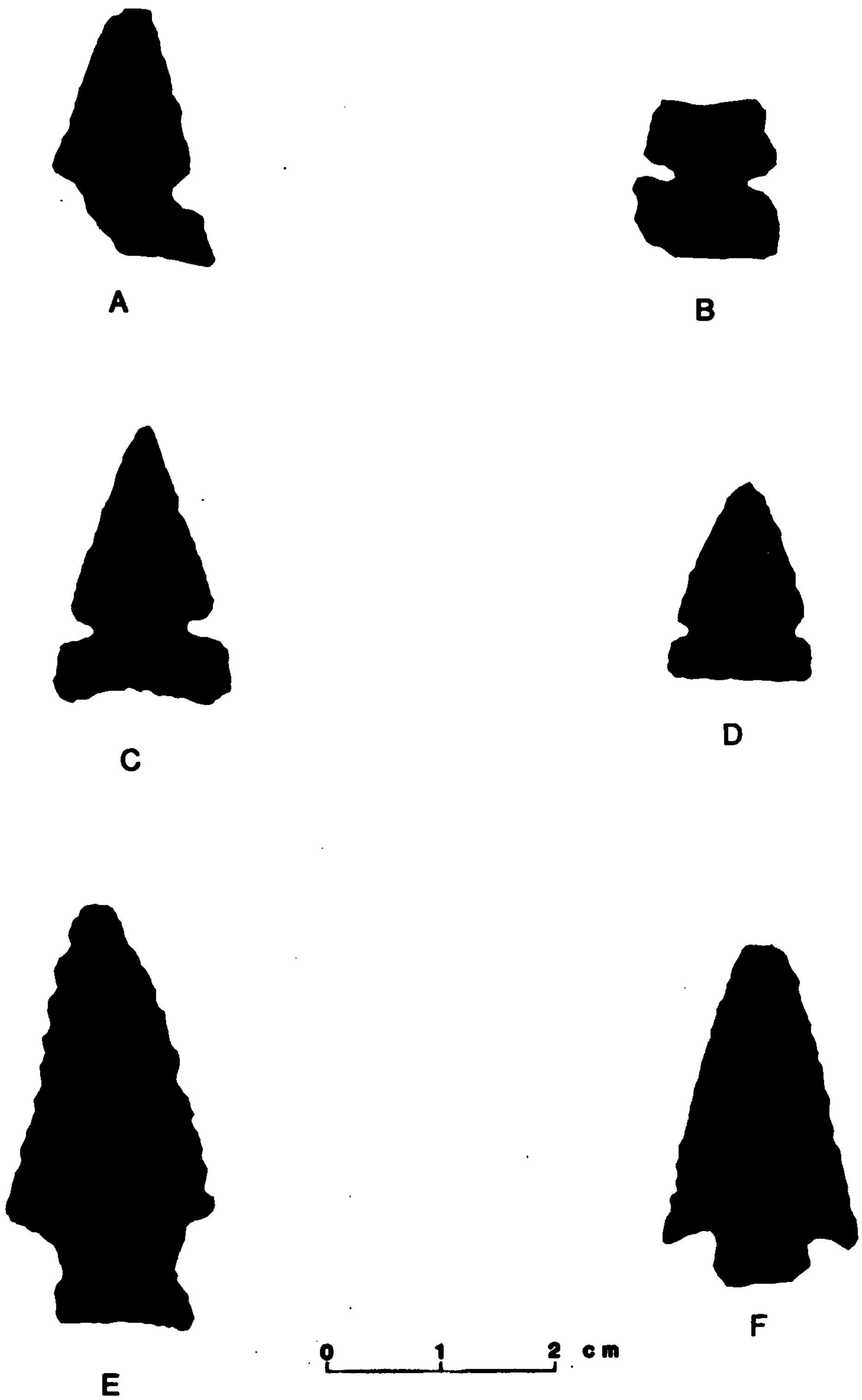
Bonham (Figure 5.5, F)

No. of Specimen: 1
Material: Gold and black mottled chalcedony
Measurements: Point No. IF116-1(1)
L=29.3mm BW=16.5mm BT=4.1mm
BL=24.3mm SL=5.0mm SW=8.0mm
W=1.6 g

Description: This specimen is slender triangular in outline, corner notched, straight blade edges, stem narrow and parallel-edged, base straight, extended shoulders, point dull but has been broken and retouched, very slightly serrated blade edges, and thin biconvex in cross-section. The workmanship is fine parallel oblique and pressure flaking.

Comparisons: Bell 1958:810, PL 5

FIGURE 5.5
PROJECTILE POINTS FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT



Washita (Figure 5.5, C,D,A,B)

No. of Specimen: 4

Material: (1) alibatz, red, white, blue, (1) light grey chert, (1) mottled light grey chert and (1) white and orange mottled chert

Measurements: Point No. IF43-1(1)
JM35-3(30)
JM43-4(11)
JM117-2(16)

L=21.8mm	BW=11.8mm	BT=2.6mm
24.9mm	12.6mm	2.9mm
14.2mm*	11.5mm	2.2mm
17.4mm*	10.9mm	3.1mm
BL=15.2mm	SL=6.6mm	SW=8.3mm*
17.8mm	7.1mm	15.8mm
6.6mm*	7.6mm	13.0mm*
12.8mm*	4.6mm	12.5mm
W=0.7g		
0.0g		
0.5g		
0.6g*		

Description: These are all finely manufactured triangular arrowpoints, side-notched, straight blade edges, stems straight to slightly expanding bases straight to concave but unnotched, and shoulders are weakly oblique. Points on the complete specimen are sharp, bases are lightly ground or unground, blade edges are unserrated to very finely serrated, and thin biconvex in cross-section. Workmanship is fine irregular and parallel oblique pressure flaking along the margins.

Comparisons: Bell 1958: 98, PL 49

Harrell (Figure 5.6, A, B)

No. of Specimen: 2

Material: (1) Pink and grey banded chert
(1) gold fine-grained quartzite

Measurements: Point No. JM61-1(2)
JM126-1(37)

L=23.4mm*	BW=13.0mm*	BT=2.9mm
17.3mm*	10.8mm	3.3mm
BL=14.3mm*	SL=9.1mm	SW=14.8mm*
11.0mm*	6.3mm	13.7mm
W=1.0g		
0.7g		

Description: The specimens are triangular in outline, tri-notched, straight to slightly convex blade edges, stem straight to slightly expanding, bases concave, weakly oblique shoulders, both specimen lack distal ends, bases and stems unground, blade edges unserrated, thin biconvex in cross-section.

Remarks: One specimen exhibits a break from the distal end and along one lateral edge. The remaining distal end exhibits roundings and slight crushing. Two subsequent flake scars are evidenced along the break. The other specimen exhibits excessive retouch on both lateral edges above the stems. The retouch flaking has caused the side notching to be partially obliterated. Both retouched lateral edges exhibit excessive rounding and polishing suggesting secondary utilization as a hafted drill.

Comparisons: Bell 1958: 30, PL 15; Suhm and Jelks 1962: 275, PL 138

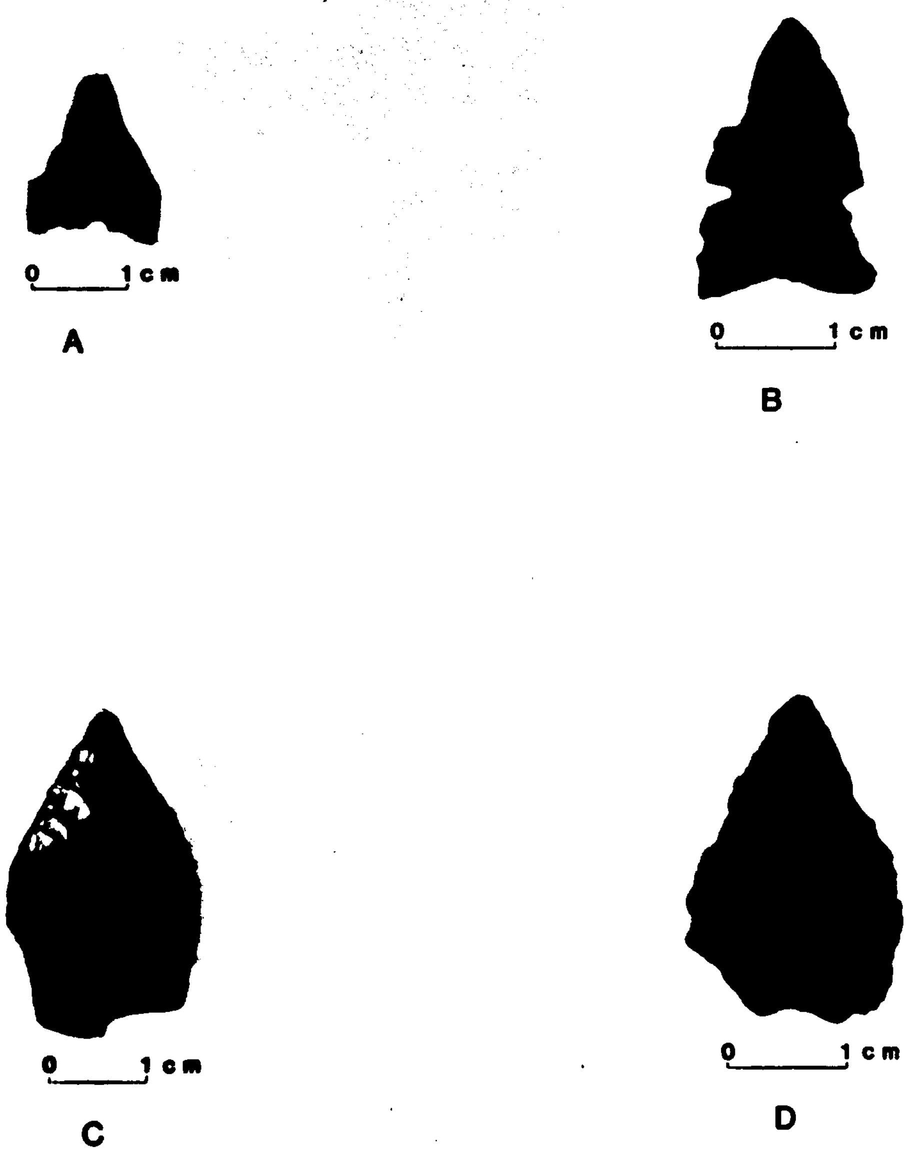
Unclassifiable Point Fragments

No. of Specimen: 5

Material: (1) grey granular chert,
(2) mottled grey chert,
(1) gold chert,
(1) light grey fine-grained quartzite

Description: These specimens are comprised of four point types and one midsection. They all lack the diagnostic indicators for classifying the artifacts with a particular cultural tradition.

FIGURE 5.6
PROJECTILE POINTS FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT



Preform (Figure 5.6, C)

No. of Specimen: 1

Material:	Gold chert	
Measurements:	Point No. JM32-1(10)	
L=35.1mm	BW=20.0mm	BT=7.3mm
BL=35.1mm	SL=N/A	SW=N/A
W=4.9g		

Description: The specimen is triangular to ovate in outline, slightly convex blade edges, and sharp tip. This specimen lacks any diagnostic indicators for the finished point. The specimen was manufactured from a fairly thick interior flake. The slightly crushed platform is still present, but the bulb has been partially thinned away. Fine irregular and parallel oblique pressure flaking is exhibited on both lateral edges and across the distal end of the dorsal surface. Medium to rough irregular flake scars are exhibited along the lateral edges and across the face of the ventral surface. Numerous thinning failure scars are also exhibited. Three deep *negative flake scars are exhibited at the proximal* end, possibly causing discontinuation of projectile point manufacture. All lateral edges and distal tip exhibit pressure retouch, irregular step fracturing, and slight crushing indicating possible utilization as a knife.

5.3.2.2 ARTIFACTS COLLECTED FROM CACHE JM022

Debitage Flakes

No. of Specimen: 1
Nonutilized/Unmodified
5 (Tertiary/Bladelike)
1 (Biface Thinning)
Utilized/Unmodified
1 (Tertiary/Bladelike)
Material: (7) Alibates
Measurements Ranges:
Length 14.6-52.4mm
Width 12.1-28.2mm
Thickness 0.6-2.6mm
Weight 0.5-3.3g

Keeled End Scraper (Figure 5.7, A)

No. of Specimen: 1
Material: Alibates Measurements:

Artifact No.	JM22-4 (4)
Length	51.4mm
Width	40.7 mm
Thickness	6.8mm
Weight	19.1g

Description: Tool manufactured from an interior flake, it has a wide scraping edge opposite the bulb of percussion. Fine steep pressure flaking is exhibited along this primary scraping edge and also extends back along the right lateral margin to form a secondary scraping edge. Both edges exhibit resharpening. The tool is slightly pear-shaped and concave, convex in longitudinal cross-section.

Biface Knife/Distal End

No. of Specimen: 1
Measurements: Artifact No. JM22-14(14)
Length 48.9mm
Width 37.5mm
Thickness 7.3mm
Weight 15.4g

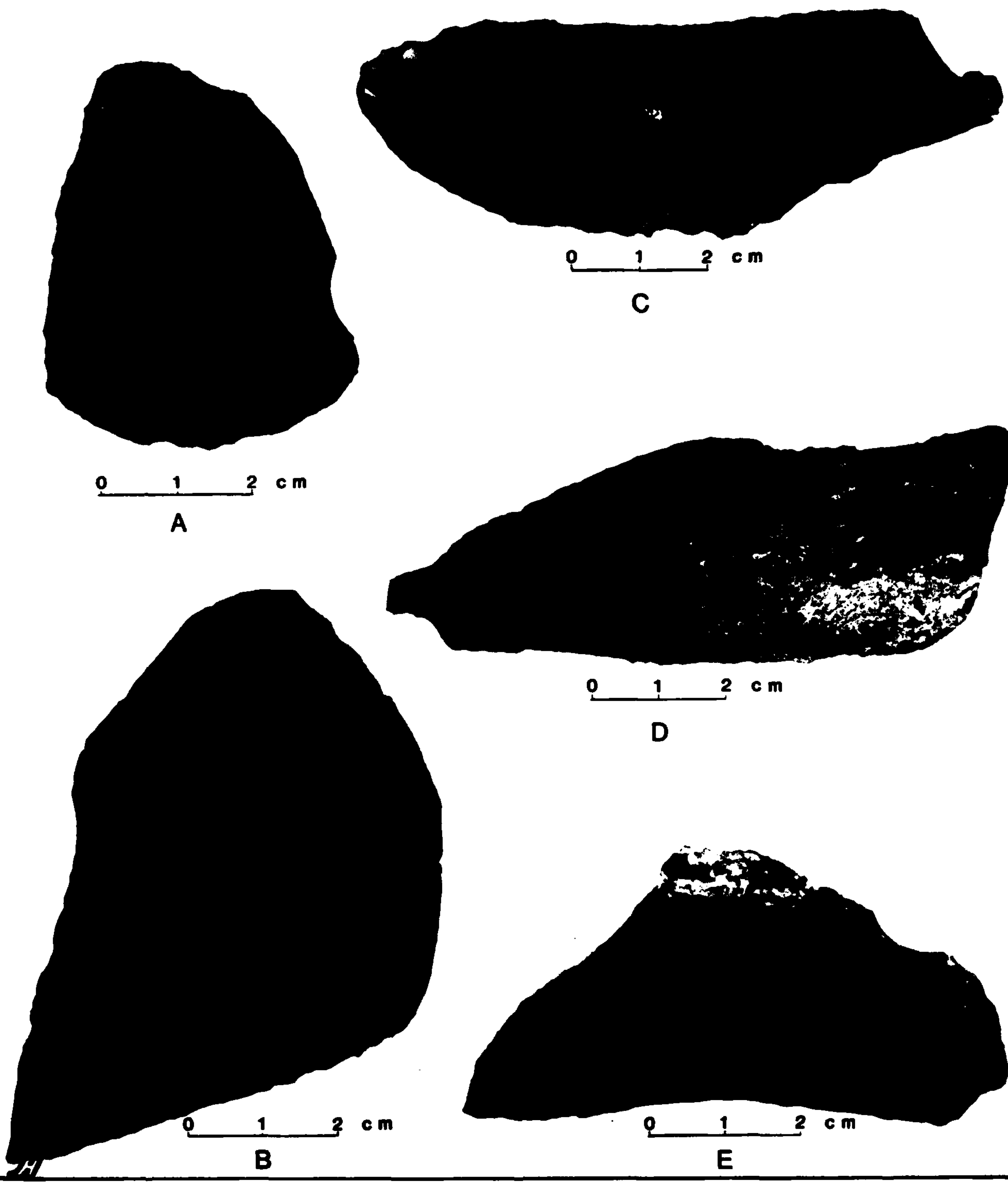
Description: This specimen exhibits parallel oblique flaking across both faces. Steeper pressure flaking is exhibited along one lateral margin, unifacial, while pressure retouch is exhibited along the opposite alternate margin. Since the tool is not complete, the exact shape is not known, but it appears to have been leaf-shaped in outline and medium lenticular in outline. A shock fracture is located at the proximal end.

Remarks: One lateral edge exhibits irregular step fracturing and slight crushing, indicative of a cutting tool.

FIGURE 5.7

SAMPLE OF ALIBATES ARTIFACTS FOUND IN CACHE, JM022

JOHN MARTIN RESERVOIR PROJECT



Leaf Shaped Blades (Figure 5.7.C)

No. of Specimen: 3
Material: Alibates
Measurements:

Artifact	Length	Width
JM22-18(18)	92.8mm*	30.4mm
JM22-3(3)	83.8mm	32.6mm
JM22-7(7)	63.9mm*	37.7mm*

Thickness	Weight
10.0mm	31.7g
6.8mm	21.8g
11.7mm	25.1g

Description: These specimen are leaf shaped in outline, plane convex to concave, convex in longitudinal cross-section and are all manufactured from blade flakes of medium thickness. Only one specimen is complete, one specimen is minus the proximal end, and one specimen is minus the distal end. All appear to be hand-held tools, and no hafting elements are exhibited. All three specimen exhibit pressure retouch on all lateral margins dorsal surface. One specimen exhibits slight pressure retouch also on the ventral lateral margins. Bulbs of percussion are present on two specimen and absent on one. A slightly crushed single faceted platform is present on one specimen.

Remarks: All three tools exhibit irregular step fracturing and slight crushing and polishing on at least one edge indicative of cutting.

Secondary Flake Uniface Tools

No. of Specimen: 2
Material: Alibates
Measurements:

Artifact	Length	Width
JM22-1(1)	93.5mm*	43.1mm
JM22-5(5)	72.4mm	43.6mm

Thickness	Weight
18.8mm	82.5g
16.6mm	44.4g

Description: These two tools have been manufactured from thick secondary flakes and cortex is present on one surface of each tool. Both tools exhibit steep unifacial pressure retouch along the margin opposite the cortex-covered portion. Both are hand-held tools.

Remarks: Unifacial parallel step fracturing, with few irregular fractures are exhibited along both retouched margins, numerous parallel and irregular step fractures are also exhibited unifacially along the opposite margin of one specimen. Both tools appear to have been utilized as scrapers primarily and possibly secondarily as cutting tools.

Knife/Awl Combination Tool (Figure 5.7, D)

No. of Specimen: 1
Material: Alibates
Measurements:

Artifact	Length	Width
JM22-15(15)	94.9mm*	33.2mm
Thickness	Weight	
5.6mm	22.1g	

Description: This is an interesting tool made from a secondary blade flake, no platform or bulb present. Steep unifacial pressure retouch is exhibited along one lateral margin, forming a cutting edge. This edge exhibits slight rounding and crushing. The distal tip has been pressure flaked to form an awl projection; this flaking forms a bifacial medial ridge. The lateral margins and medial ridges exhibit no polishing or rounding which would be present if the implement was used as a drill. The distal tip has been broken off. The implement apparently was utilized as a hand-held cutting implement and awl.

Unifacial Blade Knife (Figure 5.7E)

No. of Specimen: 2
Material: Alibates
Measurements:

Artifact	Length	Width
JM22-6(6)	70.7mm	33.6mm
JM22-8(8)	67.2mm	27.5mm
Thickness	Weight	
4.8mm	11.4g	
3.1mm	8.4g	

Description: These two tools are of interesting manufacture and shape. They are both manufactured from thin blade flakes and have been shaped on all edges by fine pressure flaking and are both of similar shape in outline. The longest margin has been unifacially pressure retouched on both tools and is slightly concave in outline. Neither tool exhibits utilization, possibly having been retouched after use. These tools were both hand held and probably were manufactured as cutting tools.

Triangular Uniface Knife (Figure 5.7, B)

No. of Specimen: 1
Material: Alibates
Measurements:

Artifact	Length	Width
JM22-9(9)	72.7mm	52.9mm
Thickness	Weight	
9.4mm	35.3g	

Description: This knife has been manufactured from an interior flake of medium thickness. A slightly crusted platform is present at the distal end, and the bulb of percussion is still intact. The blade is keeled on the dorsal surface. The flake has been fractured perpendicular to the platform, and this margin has been retouched to form a cutting edge. This edge exhibits crushing and parallel and irregular step fracturing.

Uniface

No. of Specimen: 1
Material: Obsidian
Measurements:

Artifact	Length	Width
JM22-19(10)	48.4mm	29.5mm
Thickness	Weight	
3.6mm	6.0g	

Description: The only obsidian artifact found in the cache. This tool was manufactured from a thin blade flake which was unifacially pressure flaked across the dorsal surface. No utilization was exhibited.

5.3.2.3 PATTERNED TOOLS

Unmodified Flake Scrapers

No. of Specimen: 2
Material: (1) gold chert
(2) black fine grained basalt
Measurements:

Artifact	Length	Width
JM52-3(24)	20.3mm	13.7mm
JM60-3(24)	39.3mm	26.6mm
Thickness	Weight	
4.8mm	1.5g	
8.7mm	1.4g	

Description: Small random flakes which were either purposefully or accidentally produced during the manufacture of other tools. There is no similarity in shape, but at least one side has a suitable scraping edge. Neither of the specimen show any modification. Usage flaking, parallel step fracturing, indicate utilization as convenience scrapers.

Modified Flake Side Scraper

No. of Specimen: 3
Material: (1) tan and white chalcedony
(2) black fine-grained basalt

Measurements:

Artifact	Length	Width	Thickness	Weight
JM52-1(7)	32.6mm	30.6mm	8.4mm	9.3g
JM5-2(14)	38.0mm	33.5mm	10.5mm	21.2g
IF59-1(1)	18.0mm	20.0mm	4.6mm	2.2g

Description: Irregular flakes with scraping surfaces on two edges. These tools appear to be impromptu for immediate unspecialized tasks and then discarded. No resharpening is exhibited on one specimen. The smaller of the three scrapers was manufactured from the convex end of a broken blade flake. Two of the specimen plano-convex, and one is convex in cross section.

Micro End Scraper

No. of Specimen: 1
Material: gold chert
Measurements:

Artifact	Length	Width	Thickness	Weight
JM12-1(16)	18.7mm	10.0mm	5.0mm	1.0g

Description: This specialized end scraper was manufactured from a larger secondary flake and closely resembles a microprismatic flake scraper. Both lateral edges are steep fracture planes. The scraping edge has been manufactured by steep pressure flaking and is located at a right angle to the long axis of the flake. This scraper is plano-convex in cross section.

Discoidal Scraper

No. of Specimen: 1
Material: Alibates
Measurements:

Artifact	Length	Width	Thickness	Weight
IF55-8	33.6mm	34.5mm	9.6mm	15.5g

Description: A disk-shaped flake with flaking completely covering the dorsal surfaces. Irregular flaking is exhibited on the face with fine steep pressure flaking exhibited along all margins, thus forming a scraping edge at all margins. Cross section is plano-convex. This scraper exhibits retouch on the margins, a polishing and rounding indicating heavy usage.

Combination Keeled Scraper-Graver

No. of Specimen: 1
Material: black fine-grained basalt
Measurements:

Artifact	Length	Width	Thickness	Weight
SM51-2(19)	28.0mm	22.9mm	5.3mm	4.4g

Description: This is an interesting tool, which is a combination broad end and side scraper with a narrow bit end scraper and shallow notch cuts beside it. It is manufactured from an oblong flake with fine steep pressure flaking forming the primary scraping edge at the broad distal end. This step pressure flaking also extends along both lateral margins producing tertiary scraping edges. The proximal lenticular end exhibits two deep longitudinal flake scars forming a narrow bit. The lateral margins have been pressure retouched to produce the narrow notches which possibly served as spoke-shave scrapers. This tool is slightly convex, concave in longitudinal cross section.

Remarks and Comparisons: Gunnerson states that end scrapers with projections or tangs are common to Dismal River Apache sites (Gunnerson 1960: 241-242, PL 20, 21, 22; Gunnerson 1969: 31).

Uniface Fragments With Projections

No. of Specimen: 2
Material: (1) gold chert
(1) white chalcedony
Measurements:

Artifact	Length	Width
JM28-1(7)	13.2mm*	14.3mm*
JM52-2(23)	17.4mm*	2.5mm*

Thickness	Weight
4.8mm*	1.1g
2.5mm*	9.3g

Description: These two tool fragments have been manufactured from thin interior flakes; both have narrow bit projections. These tools were possibly manufactured as spoke-shave scrapers or gravers. No steep pressure flaking is exhibited except at the concave margins from the projections. Fine pressure flaking is exhibited. No utilization is exhibited on either specimen.

Small Ovoid Biface

No. of Specimen: 3
Material: (2) black fine-grained basalt
(1) white and pink mottled chert
Measurements:

Artifact	Length	Width
JM8-2(44)	32.6mm	26.2mm
JM19-1(47)	35.5mm	25.9mm
JM116-1(2)	26.6mm	21.5mm

Thickness	Weight
11.1mm	9.2g
10.3mm	11.4g
8.1mm	4.2g

Description: Manufactured from thick flakes; two specimen retain striking platforms. Dorsal surfaces are convex and completely flaked along the margins and across the face. The ventral surfaces are flatter and retain most of the old flake scar surface; flaking occurs along all margins. Margins are uneven. One specimen exhibits no utilization, and one exhibits unifacial parallel step fracturing. The third exhibits slight crushing along lateral margins indicating use in the second tool as a scraping implement and in the third as a chopping/cutting implement. All are plano-convex in cross section.

Large Biface

No. of Specimen: 1
Material: igneous/diorite
Measurements:

Artifact	Length	Width
JM5-1(4)	128.5mm	55.3mm

Thickness	Weight
32.2mm	258.7g

Description: This large biface was manufactured from a core and a large primary or secondary flake. Bifacial percussion flaking is exhibited along all margins and across both faces; flaking is irregular, biconvex in cross section and elongated oral in outline. This is a hand-held tool exhibiting no hafting elements. Margins are sharp but slightly rounded due to weathering. No utilization is exhibited possibly due to weathering and/or percussion retouch after utilization.

Triangular Biface Knife

No. of Specimen: 1
Material: Alibates
Measurements:

Artifact	Length	Width
IF102-1(1)	62.4mm	38.0mm

Thickness	Weight
8.6mm	16.6g

Description: This tool has been manufactured from a flake of medium thickness and is well thinned. Medium irregular flaking is exhibited extending across both faces. Parallel oblique pressure flaking is exhibited bifacially along one margin. This margin has a finely serrated edge and is sharp exhibiting few ir-

regular step fractures. The opposite margin exhibits irregular pressure flaking and has an irregular edge. This edge exhibits slight crushing and rounding. The point is dull and shoulders are rounded. The base has been bifacially retouched and has been thinned for hafting. The tool is medium biconvex in cross section.

Leaf Shaped Biface

No. of Specimen: 1
Material: black fine-grained basalt
Measurements:

Artifact	Length	Width
IF14-1(1)	45.2mm	20.0mm
Thickness	Weight	
8.77mm	9.1g	

Description: This small biface was manufactured from a primary flake with only minimal modification. All margins exhibit pressure retouch; cortex is still visible covering the entire dorsal face; and the ventral face is the original flake face. The basal portion exhibits slight thinning, possibly for hafting. Lateral margins exhibit slight parallel and irregular step fracturing; edges are slightly crushed.

Drill (Figure 5.6, D)

No. of Specimen: 1
Material: Brown chert
Measurements:

Artifact	Length	Width
JM53-1(1)	27.2mm	18.0mm
Thickness	Weight	
5.1mm	2.4g	

Description: This small drill is bifacially pressure flaked, irregular flaking across both faces and base, upper lateral margins exhibit steep pressure flaking to form a slightly beveled tip. Distal-end (tip) exhibits rounding and polishing.

Bifacially Worked Fragments

No. of Specimen: 8
Material: (2) grey medium-grained quartzite
(1) brown medium-trained quartzite
(1) brown and black petrified wood
(1) grey-brown chert
(1) grey chert
Measurement Ranges:
Length: 23.3 - 53.6mm
Width: 22.2 - 42.8mm
Thickness: 6.0 - 16.6mm
Weight: 3.7 - 29.6g

Description: This collection consists of three basal fragments and five distal ends. All are randomly pressure flaked. Three of the distal-end fragments exhibit slight crushing and irregular step fracturing on at least one margin indicating utilization as knives. The rest of the fragments are nondiagnostic; all are biconvex in cross section.

Debitage Flakes

No. of Specimen: 2
Nonutilized/Unmodified
1 (Secondary)
0 (Tertiary)
1(Total)

Utilized/Unmodified
0 (Secondary)
1(Tertiary)
1(Total)
Material: (1) white quartzite
(1) brown chert
Measurement Ranges:
Length: 17.2 - 39.9mm
Width: 14.0 - 43.4mm
Thickness: 3.8 - 10.7mm
Weight: 1.0 - 19.2mm

Choppers

No. of Specimen: 2
Material: (1) gold fine-grained quartzite
(1) black fine-grained basalt
Measurements:

Artifact	Length	Width
JM17-1(8)	73.1mm	56.0mm
JM117-1(101)	95.9mm	69.5mm
Thickness	Weight	
20.2mm	126.8g	
46.7mm	434.2g	

Description: These are hand-sized cottles with bifacial trimming by percussion flaking along one or two margins. One specimen was manufactured from a naturally beveled cobble, diamond sloped in longitudinal cross section and trimmed on two margins. Both margins exhibit crushing and rounding. One specimen exhibits trimming on one margin only and was manufactured from a round, flat cobble. Slight crushing and few irregular step fractures are exhibited.

Mano

No. of Specimen: 1
Material: Tan fine-grained sandstone
Measurements:

Artifact	Length	Width
IF25-14	15.5 mm	132.8mm
Thickness	Weight	
30.2mm	947.7g	

Description: A sandstone grinding stone that could be held in one hand. It is oval in outline, the perimeters have been pecked to slope. This specimen exhibits a convex grinding surface with a median ridge and striations perpendicular to the ridge on both faces. The ridge and grinding striations are asymmetrical. (Grinding areas are at right angles to each other on opposite faces.)

Shallow Basin Slab Metate

No. of Specimen: 1
Material: tan fine-grained sandstone
Measurement:

Artifact	Length	Width
JM134-1(34)	460.0mm*	05.0mm*
Thickness		
50.0mm*		

Description: The first type of grinding slab is an elongated oval in outline. It was originally at least twice the present width with shallow lapin grinding surfaces on both faces. Striations are exhibited running centrally parallel to the long axis with grindings as polish all over the utilized faces. During utilization the central grinding area wore completely through, and the slab was then broken in half longitudinally forming a long narrow grinding surface. This third surface also exhibits parallel striations running along the central axis to form a shallow basin. The original metate was shaped by chipping which can be seen along the remaining original margins. The specimen also exhibits some oxidation.

Shallow Basin Metates (Figures 5.8, 5.9, and 5.10))

No. of Specimen: 2
Material: tan fine-grained sandstone
Measurements:

Artifact	Length	Width
JM114-2(101)	*	225mm
JM134-4(30)	400mm	320mm
Thickness	Weight	
70mm	100g	

Description: These two grinding stones are oval in outline. Outside margins were pecked to shape; the basin areas were also initially pecked before being ground; evidence of the pecking is still visible. Grinding surfaces are oval basins; striations are exhibited running perpendicular and central to the long axis. One specimen

FIGURE 5.8
METATES FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT

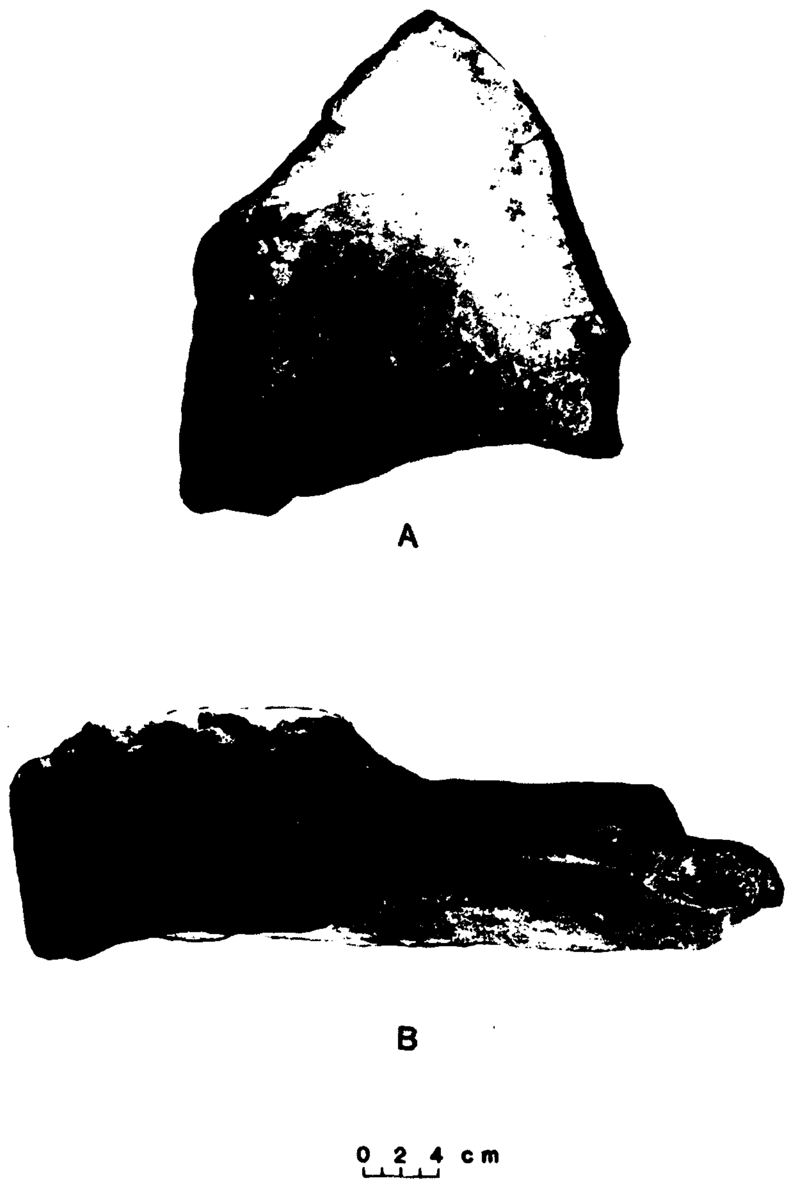
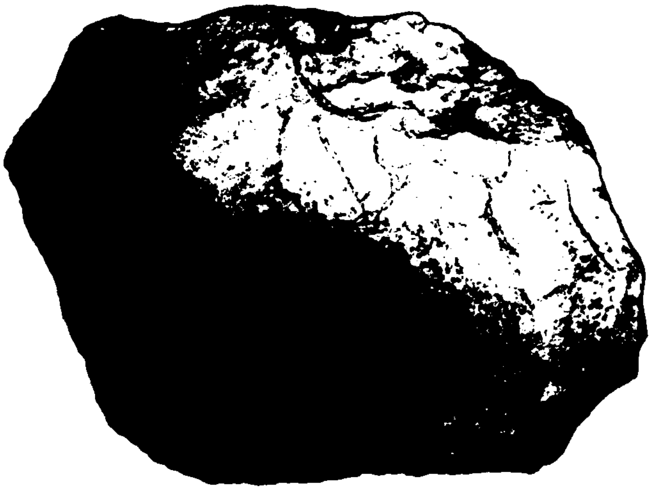


FIGURE 5.9
METATES FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT

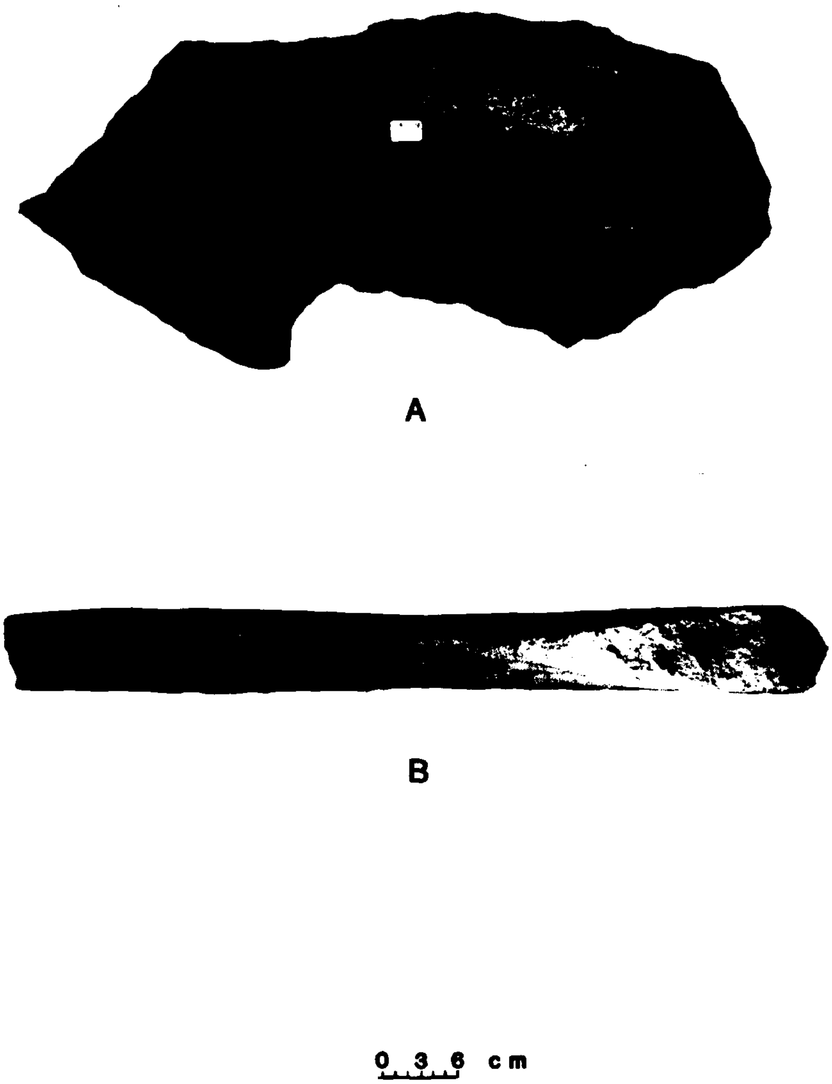


A

B

0 3 6 cm

FIGURE 5.10
METATES FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT



exhibits oval basin grinding surfaces on both faces. Grinding and polishing exhibited over the entire face. One specimen exhibits less utilization with grinding only in the basin area.

Hammerstone

No. of Specimen: 1
Material: grey volcanic diorite
Measurement:

Artifact	Length	Diameter
JM33-1(11)	45.7mm	56.5mm
Weight		
256.8g		

Description: This fractured hammerstone is a rounded and polished wire cobble, picked up and utilized as it was found. Pitting and abrasions are found on one end exhibiting heavy utilization.

Pallate

No. of Specimen: 1
Material: grey and brown mottled siltstone
Measurement:

Artifact	Length	Width
JM33-2(12)	67.7mm	72.8mm
Thickness	Weight	
20.2mm	49.7g	

Description: This is a rectangular slab with a rectangular, pecked surface on one face forming a slight depression. The pallate exhibits extensive weathering and lichen activity. No striations are visible in the pecked area, nor is any pigment visible. The artifact has been classified as a pallate here because of the slope and appearance.

5.3.2.4 POTTERY

Cord-Marked Micaceous Pottery (Figure 5.11, B)

No. of Specimen: 5 body sherds representing one vessel
Artifacts: JM35-1A(5), JM35-1B(6), JM35-1C(7), JM35-1D(8), and JM35-1E(9)
Measurement Ranges:

Length:	20.8* - 47.1mm*
Width:	14.7* - 34.0mm*
Thickness:	5.3 - 6.5mm
Weight:	2.3 - 14.9 gram

Method of Manufacture: This specimen was probably lump modeled; there is no evidence of coiling, paddle, and anvil thinning.

Paste and Tempering: These are fine river sands and clay, relatively unsorted. The clay contains subangular particles of quartz, muscorite, and quartzite. The finely divided muscorite (mica) is visible mainly on or near the surfaces of the sherds. Studs tend to be friable; paste near the surfaces appears slightly laminated.

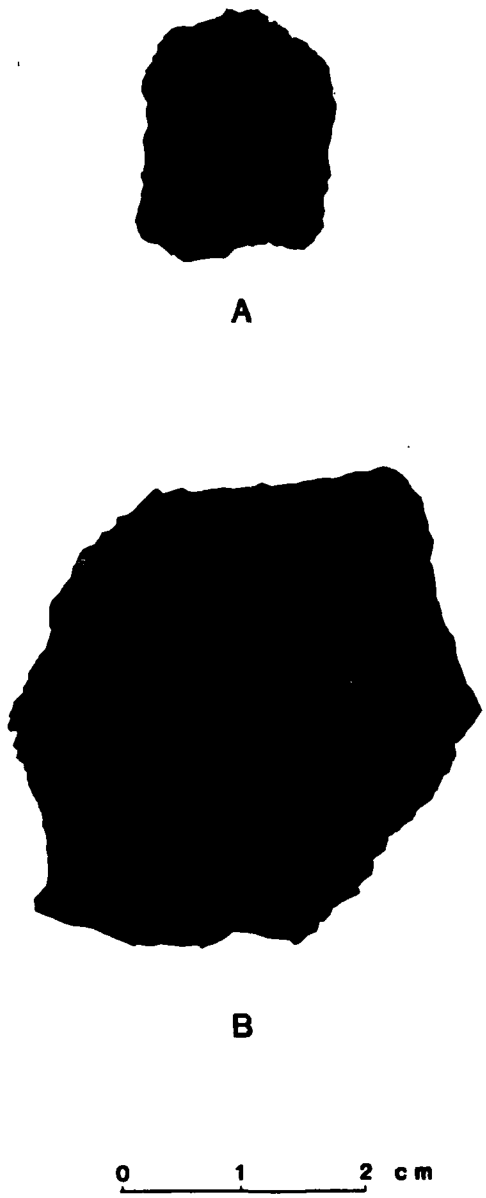
Color: Exterior surfaces are reddish-brown to dark grey. Cores are dark grey to black.

Texture: It is medium to well worked, possibly kneaded, compact but blocky cores.

Surface Finish: The interior and exterior are smoothed but not polished. Three of the small sherds are plain with no stamping or cord markings. The two-layer sherds which appear to be upper body sherds exhibit parallel cord impressed markings 1-2 mm apart (PL 15.6, a). These two sherds have been smoothed to such an extent that the cord markings have been partially obliterated. Thus, it is impossible to determine the type of cord markings (ex. S or Z twist, 1- or 2-ply).

Comparisons: Gunnerson 1968: 175, PL 3; Gunnerson 1960: 184, 213-214; Metcalf 1949: 254.

FIGURE 5.11
CORD-MARKED POTTERY FROM SURFACE COLLECTIONS
JOHN MARTIN RESERVOIR PROJECT



Plain Micaceous Pottery

No. of Specimen: 1 representing one vessel

Measurements:

Artifact	Length	Width
JM132-21(33)	18.3mm*	13.3mm*
Thickness	Weight	
5.2mm	1.4g	

Method of Manufacture: This was probably lump modeled, no evidence of coiling, paddle and anvil thinning.

Paste and Tempering: These are fine river and dune sands with subangular to subrounded particles. The clay used contains subangular medium to coarse particles of quartz and few finely divided particles of muskovite.

Color: Exterior surfaces are dark grey to buff; the core is dark grey to black.

Texture: It is fine and well-worked, compact in structure.

Surface Finish: The exterior surface and interior surface (to a lesser degree) appears polished with a relatively smooth burnished appearance. No incising or impressing is exhibited.

Remarks: This pottery type is possibly Lovett Plain, a Dismal River Apache Ware.

Comparison: Metcalf 1949: 252.

Quartz Tempered Pottery (Figure 5.11 A)

No. of Specimen: 2 representing two vessels

Artifacts: JM36-1(42) and JM81-1(1)

Measurement Ranges:

Length: 19.7* - 26.8mm*

Width: 15.5* - 15.6mm*

Thickness: 6.7 - 7.7mm*

Weight: 2.6 - 3.2g

Method of Manufacture: These were probably lump modeled with paddle and anvil thinning. There is no evidence of coiling.

Paste and Tempering: These are river sands and clay, relatively unsorted, subangular to subrounded particles, more mature than those found in the temper of sherds from JM035. The sands and clay contain coarse particles of clear and smoky quartz and feldspar.

Color: Exterior surfaces are reddish brown to light grey. Cores are also reddish brown to light grey.

Texture: These are medium to coarse with compact but blocky cores.

Surface Finish: The interior and exterior are smoothed but not polished. One sherd exhibits very faint parallel and irregular incising on the exterior surface. The other sherd exhibits parallel, twisted cord-impressed markings about 1 mm apart. The two sherds have been smoothed over the top of the incisings and impressing; thus it is impossible to determine the twist and a ply number.

Remarks: The pottery is similar to certain late Upper Republican and Dismal River Wares (Wheat 1981, pers. comm.).

5.3.3 SUMMARY

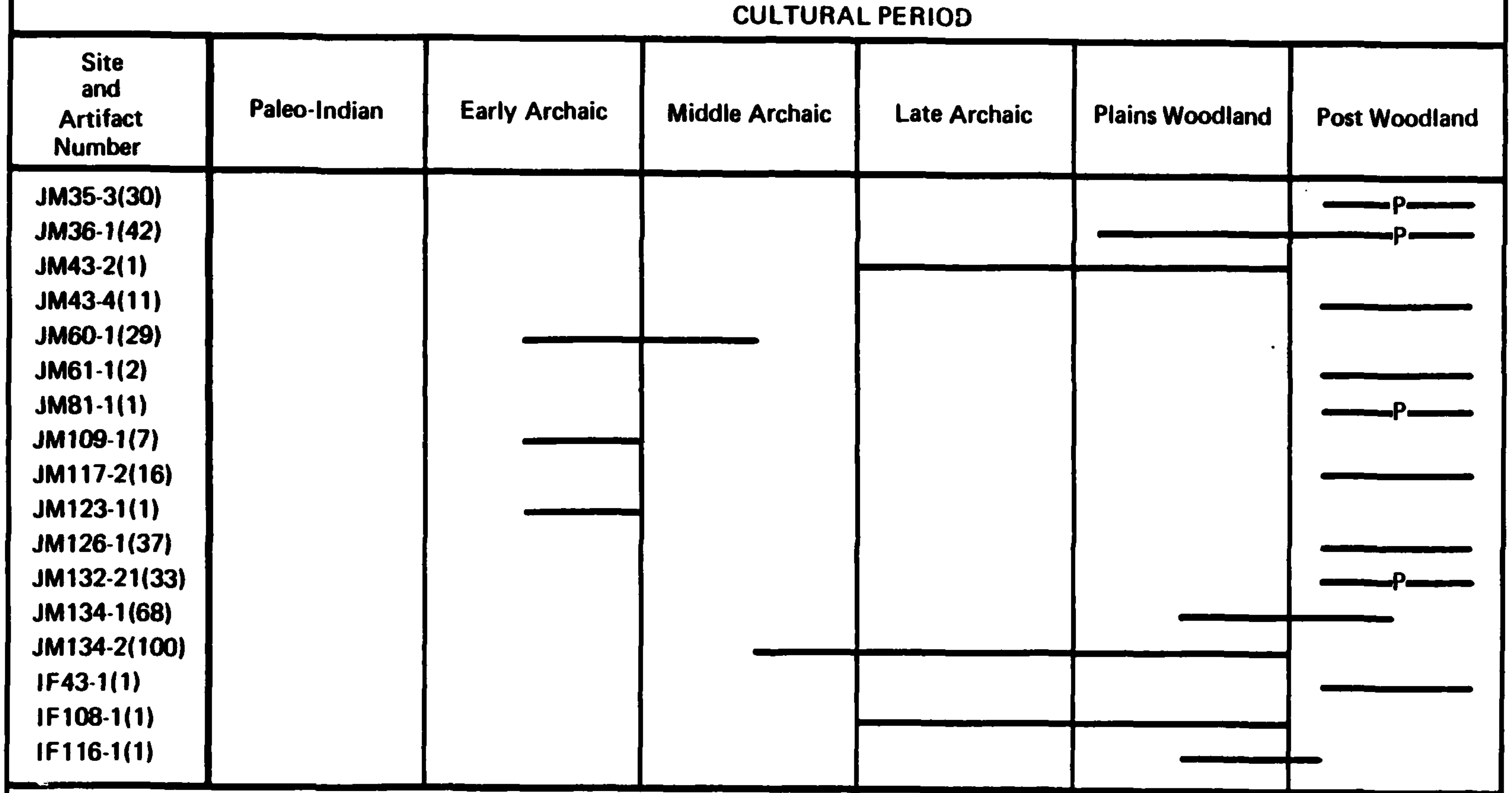
The 1980 field season resulted in the collection of 83 artifacts from a total of 31 sites and 10 isolated finds (Table 5.4). The purpose of this study was the description and inventory of the collected surface artifacts.

The artifacts that were recovered indicate that the John Martin area has been utilized sporadically for at least the last 6,000 years (see Figure 5.12). From examination of the projectile points and pottery, it has been found that

TABLE 5.4
COLLECTED SURFACE ARTIFACTS
JOHN MARTIN RESERVOIR PROJECT

		Debitage			Patterned Tools																		Pottery				
JM Site Number	IF Number	Utilized/Unmodified	Utilized/Unmodified	Slightly Modified	Point Fragments	Projectile Points	Preforms	Drills	Combination Scraper/Graver	Scrapers	Combination Scraper/Knife	Unifacial Knives	Bifacial Knives	Combination Knife/Awl	Unifaces	Bifaces	Biface Fragments	Choppers	Hammerstones	Pallates	Manos	Metates	Cored Marked Micaceous Ware	Plain Micaceous	Cored Marked and Incised	Quartz Tempered	Total Artifacts Per Site
5										1						1											2
8																1	1										2
12										1																	1
	14															1											1
17																		1									1
19																1											1
	19					1																					1
22		6	1							1	2	5	2	1	1												19
	25																				1						1
28															1												1
32							1																				1
33																			1	1							2
35					1	1																	5				7
36																										1	1
43						2																					2
51					1				1																		2
52				1						2					1												4
	52		1																								1
53								1																			1
	55									1																	1
	59									1																	1
60						1				1																	2
61						1																					1
62																	2										2
63																	1										1
81																										1	1
	102												1														1
104					1																						1
	108					1																					1
109						1																					1
110																	2										2
	111																1										1
114		1																				1					2
116																1											1
	116					1																					1
117					1	1												1									3
120																	1										1
123						1																					1
126					1	1																					2
132																								1			1
134						2																2					4
Total 31	10	7	2	1	5	14	1	1	1	8	2	5	3	1	3	5	8	2	1	1	1	3	5	1		2	83

FIGURE 5.12
CULTURAL CHRONOLOGY OF COLLECTED SPECIMENS
JOHN MARTIN RESERVOIR PROJECT



Key: —— *Indicates Time Span For Each Dateable Specimen*
P Pottery Fragments, All Others Are Projectile Points

each stage of Plains cultural history from mid-early Archaic to Dismal River Apache is documented. The nondiagnostic little material reveals the presence of both hunting and horticultural subsistence.

The cultural time span represented best by diagnostic artifacts in the collection is the post-Woodland Period. Six late, small triangular arrow points were recovered. One of these was in direct association with five fragments of Dismal River Pottery (JM035). Three other pottery fragments were also identified as late Upper Republican-Dismal River Wares. Further research into this aspect revealed that Dismal River Apache were present in the area of south-eastern Colorado circa 1700. Further, several characteristics similar to those described by J. Gunnerson have been noted: In our survey of the reservoir area, three scrapers with projections or gravers were recovered. Gunnerson states that "end scrapers with projections or tangs are common to the Dismal River Aspect" (Gunnerson 1960: 241-242, PL 20, 21, 22). He later states that "end scrapers with projections or tangs appear to be diagnostic of Dismal River" (Gunnerson 1960: 184).

Gunnerson also describes the Dismal River Apache dwelling. "This pit house does not resemble any Plains Apache structure yet excavated further comparisons may show its closest affinities to be with the forked-stick Navaho hogan, which was sometimes built over a pit and often had rocks around the base outside" (Gunnerson 1969: 37). Although we did not record any pit-house structures at John Martin, several petroglyphs at JM128 display Navaho hogan-type houses (Section 5.5).

With this as evidence, it seems certain that semisedentary horticultural Dismal River Apache were present at John Martin Reservoir.

5.3.4 GLOSSARY OF TERMS

The following common terminology is used in the analysis of artifactual material. All definitions, except those annotated, were provided by Gary S. Moore (Moore et al. 1980: 414-421).

Amputated: The severing of a flake, blade, or artifact either by applied force or end shock. Syn.: truncated, severed (Crabtree 1972: 33).

Artifact: An object of any type made by human hands. Tools, weapons, pottery, and sculptured and engraved tools are some examples of artifacts.

Awl: A pointed tool for making holes, as in leather or wood.

Barb: A projection on the lateral margins of an artifact, sometimes near the base, which slants in a direction from the distal toward the proximal end (Crabtree 1972: 36).

Basal Grinding: Intentional abrading and smoothing of the margins of an artifact. Accomplished by rubbing the margin of the artifact on some abrasive material. Presumably done to facilitate hafting (Crabtree 1972: 36).

Basal Portion: Proximal end (Crabtree 1972: 36).

Blade: A specialized flake removed from a prepared core - not a random flake, the length is equal to or more than twice the width. A long slender flake often utilized as a tool, knife, or scraper (Crabtree 1972: 42).

Bulb of percussion: A rounded protrusion on the ventral side of the proximal end of a flake.

Burin Break: Scar left on a flake or blade resulting from the removal of a burin spall. The right angle edge of a break is severed transversely from force applied to the margin (Crabtree 1972: 50).

Cache: A store of hidden goods, or a hiding place used for storage.

Chipped Stone: The class of artifactual material composed of stone tools and debitage produced by flaking techniques.

Cortex: The outer natural surface of a stone.

Diagnostic Artifact: An artifact whose morphology or construction is characteristic of a particular time period or geographic location.

Dorsal: Outer surface. Keeled part of blade or flake , for instance, the dorsal side of a blade is the face of the core prior to detachment (Crabtree 1972: 59).

End Scraper: Beveled implement made on flake or blade with working edge on one or both convex ends. The bevel is formed by unifacial flaking or by use (Crabtree 1972: 60) (also Section 7.1.1).

End Shock: Transverse feature due to the stone exceeding its elastic limits. Failure of the material to rebound and recoil before fracture occurs (Crabtree 1972: 60).

Face: The dorsal or ventral surface of the artifact (Crabtree 1972: 62).

Finished Tool: See patterned tool.

Flake: Any piece of stone removed from a larger mass through the application of force, either intentionally, accidently, or by nature. A flake may serve as a tool or be modified to serve as a tool. Flakes are also a byproduct of chipped-stone tool manufacture, i.e., waste flakes. Flakes usually exhibit a striking platform and are made from lithic material which exhibits a conchoidal fracture.

Flaking: The process of lithic reduction in stone tool manufacture by which a stone is struck with another stone, bone, horn, or wood to produce flakes.

Flake Scar: The negative impression left in the lithic material by the removal of a flake.

Lithics: Derived from the Greek word Lithos-stone. Pertaining to stone.

Lithic Reduction (subtractive manufacture): The process of manufacturing stone tools by taking away exterior portions in order to shape the resultant object.

Lithic Tools: Stone tools, usually manufactured by lithic reduction, e.g., projectile points, scrapers, knives, etc.

Notch: Side or basal indentations to facilitate hafting.

Oblique Flaking: Flakes removed diagonally to the long axis of the artifact. Parallel flaking directed diagonally across the surface of the artifact. Generally done by the pressure technique (Crabtree 1972: 79).

Parallel Flaking: Flake scars are parallel to each other, uniform or graduated in size, and leave a sharp straight edge. This technique was applied to direct the flakes across the face of the artifact, making it stronger and more regular. This type of flaking is accomplished by the serial removal of blades continuously across the face of the surface worked. The flake platform is placed in line

with a ridge with the greatest force applied directly perpendicular to margin with pressure tip. The tool must be kept in line with ridge during detachment (Crabtree 1972: 80).

Patterned Tool (finished tool): A stone implement manufactured in a particular form and style, e.g., a projectile point, a scraper.

Platform (striking platform): The surface area of a core or a flake which receives the force necessary to detach a flake.

Percussion (percussion flaking): A method of striking stone to remove flakes by impact, collision, or concussion.

Polishing: To make smooth by rubbing with fine abrasive material. Strengthens the platform. Can also be the result of function (Crabtree 1972: 84).

Preform: Preforming denotes the first shaping. A preform is an unfinished, unused form of the proposed artifact, and is larger than, without the refinement of, the completed tool.

Pressure Flaking: A method of pushing steadily against stone to remove small flakes in forming and sharpening a tool.

Proximal End: The end of a flake where percussion or pressure was applied to remove the flake from the core; often the end opposite the flake's pointed end.

Retouch Flake: A small flake removed from a tool or another flake usually by the use of pressure, in order to thin, straighten, sharpen, and smooth.

Serrating: Indenting the edges by alternating the removal of flakes or the repeating of notches at regular intervals (Crabtree 1972: 90).

Step Fracture: A flake or flake scar which terminates abruptly in a break that is essentially at right angles to the previous fracture path (Cotterell and Kamminga 1979: 105). These appear as small hinge fractures or steps located on the surface near the perimeter of the utilized portion of the artifact.

Striking Platform: See platform.

Typology: A classification by form, technique, and technological trait. Function is sometimes a fourth criterion.

Uniface: An artifact flaked on one surface only.

Ventral Surface: The inner side of a flake, the surface which was originally attached to the core.

5.4 SITE CHRONOLOGY

In this section, we will examine the nature of the chronological data which can be brought to bear in the study of the functional and, especially, the evolutionary propositions first presented in Section 4.3.2. This is important to the course of the hypothesis evaluation because without sufficient chronological control, it will not be possible to fully perform either synchronic or diachronic tests.

It is important to point out at the outset that no absolute means of dating were obtained and, in fact, surface collections do not generally lend themselves to these kinds of chronological analyses. Instead, it was our expectation that relative dating could be effected on the artifactual and site data through stylistic analysis of time sensitive artifacts, particularly projectile

points and pottery. For this reason, both classes of dateable specimens were field collected and analyzed in considerable detail as reported in the proceeding Section 5.3. Using the stratigraphic and radiocarbon dated age of each named projectile point and pottery type, the age of 17 specimens was determined, as graphed on Figure 5.12. Because the sites are surface exposures and could have been occupied many times over, it was anticipated that each site, in fact, may be of several different ages. This expectation is borne out by sites JM043 and 134, each of which yielded dateable artifacts of two different ages. Further, the site dating seemed particularly risky since most sites produced only one time-sensitive specimen. Given these limitations, the dating of the few sites yielding time-sensitive specimens must be considered with reservation.

The 12 sites with dateable artifacts were arranged in terms of five chronological periods as shown on Figure 5.13. The five temporal periods are an attempt to order the sites in time in order to provide a basis for testing the evolutionary proposition as carried out in Section 6.5.1. Without sufficient time control, no attempt was made to perform functional analysis on sets of sites broken out by time period. Instead the entire block of prehistoric sites is used for this purpose.

Inspection of privately owned artifact collections held in the city of Las Animas leads us to the conclusion that surface collection has been a favorite pastime of local residents for many years. Apparently, it is this practice that has seriously depleted the population of dateable specimens on the majority of the John Martin Reservoir prehistoric sites. For his reason, only 11.0 percent of the prehistoric sites could be dated and then only by the presence of one or two specimens.

5.5 ROCK ART

Three sites recorded in the John Martin Reservoir survey contain rock-art features. All three sites have been recorded previously. Two of these, JM117/5BN122 and JM128/5BN7, have been previously recorded as rock-art sites (Colorado Archaeological Society Survey 1971). There had been no previous observation pertaining to pictoral art at the remaining site, JM104/5BN14. Six other rock-art sites have been recorded in the project area (Renaud, 1930s; Wheat in COE 1974). Due to weathering and wave action since construction of the John Martin Dam, they are no longer visible.

Since the rock art of the three sites demonstrates different styles, they will be presented individually in this section.

5.5.1 DEFINITION OF TERMS

Rock art refers to all graphic representations on stone. A further distinction is made between painted surfaces and carved rock surfaces. Pictographs are defined as painted figures. Any pecked, incised, or abraded surface is termed a petroglyph. All of the rock art recorded in the project survey are petroglyphs.

Elements are defined as rudimentary parts standing as a unit or composing a figure. A panel is defined as a rock wall of figures creating a unit. JM117/5BN122 features five rock-art groups at five different locations, labeled Group or Panel A, B, C, D, and E. Group C contains two panels spaced several meters apart, which are labeled Panel C and C-1.

A motif is a figure or group of figures which occurs repeatedly in various rock-art styles.

Patination refers to the degree of weathering between the altered rock surface and the original rock face. Superimposition is another term used in age placement of rock art and refers to additional carving or painting onto an original after a period of time.

FIGURE 5.13 LIST OF DATED PREHISTORIC SITES*

Period 1, early Archaic: JM109, 123

Period 2, early through middle Archaic: JM060

Period 3, middle Archaic through Plains Woodland: JM134

Period 4, late Archaic through Plains Woodland: JM043

Period 5a, Woodland through Dismal River: JM036 (pottery), 134

Period 5b, post-Woodland: JM035 (point, pottery), 043, 061, 117, 126,
JM132 (pottery)

* Taken from Figure 5.12

The method of producing the rock art of the three sites described in this report was by pecking or incising. Pecking is produced by uniformly chipping the rock face. Incising results in a sharper form, made by scratching into the rock surface with a sharp tool. Sometimes these incisions are ground further.

The tools used in the manufacture of the petroglyphs could not be determined by the data.

5.5.2 PREVIOUS STUDIES IN THE AREA

The earliest recordings of rock art in the survey area were made by E. B. Renaud in 1930-1937 and J. B. Wheat in 1954. They found, in addition to those of the C.A.S. (1971), eight pictoral art sites within the project boundary. It is interesting to note that of these eight sites found in the literature search, only two remain. An additional petroglyph site, JM104/5BN14, was recorded by the John Martin field crew; no rock art had been observed when this site was previously recorded. Five of the eight sites were found in Rule Creek or at the confluence of Rule Creek and the Arkansas River. Two were situated on the north bank of the river and the one remaining was on the south bank. With the exception of 5BN114 which was destroyed by construction of a railroad bridge, the other five previously recorded sites did not withstand the weathering and exposure to water caused by the construction of John Martin Dam.

Campbell's (1969a) studies of rock-art sites in southeastern Colorado attempt to develop a dating method based on a frequency correlation of rock artistry with associated sites and/or archeological material. He finds no rock art associated with early prehistoric traditions. He states that middle prehistoric (Archaic) materials are found near rock art, but only when later materials are present; therefore, only late prehistoric horizons are considered in his listing of three phases or foci. They are as follows: Graneros, A.D. 450 to 1000; Apishapa, A.D. 1000 to 1300; Dismal River Aspect, A.D. 1550 to 1750; and Horse Nomad, A.D. 1750 to 1885.

Stuart (1978) has done extensive work at Hackberry Springs, south of the project area (5LA1115). Nine rock-shelter features containing an abundance of rock art were recorded. Three stylistic periods were identified, based on superimposition and differential patination. The earliest is a stipple-pecked style dominated by zoomorphs and curvilineal abstractions. The following style is characterized by solid and neatly pecked zoomorphs. The most recent style consists of incised, parallel, linear elements.

The rock art of the Hackberry site most clearly resembles that of the Navajo area in northern New Mexico (Schaafsma 1963, 1975.) The thunderbirds of Gobenador Canyon and Hackberry Springs were found to be identical. The time period for the Gobernador Phase is 1698-1775.

Buckles (1971) uses a stylistic analysis to identify rock-art styles of the Uncompahgre area with a specific ethnic group. He defines a late and early Historic Style based on earliest evidence of the horse. Late Historic Style is characterized by realism, although not naturalistic. Figures are stiff and static. Early Historic Style is characterized by lineal lines in depicting animals, the emergence of the buffalo as a theme, and curving lines suggesting animation in the depiction of human figures.

Three nonhistoric styles of life forms are defined by content rather than time, although much of it, he feels, is prehistoric. The three styles are grouped to indicate art forms resembling one another but not necessarily the same ages.

Style 1 shows a similarity to Historic Life

Forms as a major criteria. There is a lineality of form which is static and immobile.

Style 2 is fuller bodied, more realistic than linear Style 1 and features sheep predominately as game animals.

Style 3 is a stiffly represented realism characterized by clearer presentations of features of animals, such as hooves, horns, ears, and distinct tails. There is a stiff animation to this style, such as legs in angles projecting a "flying gallop". Style 3 exhibits a culture contact (shore birds, humpbacked flute player) over a wider area than is indicated in Style 2.

In an unpublished manuscript, Buckles (1980) has obtained radiocarbon dates from the Clay Creek petroglyph site, 5PW2, in Prowers County Colorado, which is representative of the Great Basin Curvilinear Art. The petroglyphs were buried by alluvium which was partially washed away in the flood of 1965. The alluvium was identified as Piney Creek by Glenn Scott of the U.S. Geological Survey and estimated at A.D. 100-1550 B.C. Charcoal from a firepit adjacent to the petroglyphs and within the Piney Creek Alluvium was radiocarbon dated at A.D. 100+/-100 (Sample I-7907, not MASCA corrected). Therefore, Buckles concludes that "the rock art of 5PW2 dates to earlier than the deposits of alluvium which covered the sandstone, or the radio-carbon date of A.D. 100 +/-100 of a firepit in the Piney Creek Alluvium deposits. How much earlier is unknown."

5.5.3 FIELD METHOD STATEMENT

Petroglyphs were found on three sites of the project area. Their locations were mapped on the site area. Drawings were made to scale of the rock art on JM104 /5BN14 and JM117/5BN122. A sampling of motifs was sketched for JM128/5BN7. Color slides were taken as well as black and white photographs of all of the rock art seen in the project area.

5.5.4 ROCK-ART SITE DESCRIPTIONS

Three sites in the reservoir area contained rock art. Each is described below.

5.5.4.1 JM104/5BN14

The rock art of JM104/5BN14 has not been recorded previously. The site is located on the southeast bank of the reservoir and contains a panel which is located in a natural hole on the west side of a large sandstone outcrop. The panel is composed of two rows of parallel, vertical lines (Figure 5.14). Row A measures 87.5 m; Row B is 27.5 m in length. The lines have been incised and ground into grooves. The grooves are 1 m in depth.

5.5.4.2 JM117/5BN122

JM117/58N122 is one of the previously recorded rock-art sites (C.A.S. 1971). It is located at the confluence of Rule Creek and the Arkansas River. Five groups of rock art, almost entirely curvilinear abstractions, surround the vertical walls of the site butte.

Group A is dominated by three figures made of vertical lines, solidly pecked, which are crossed by horizontal lines or rectangular bars. Also present are two wavy, vertical lines, one straight line, two circles, and a right angle element. (Figure 5.15).

Group B petroglyphs are very faint. The rock face is highly eroded and broken, leaving unclosed lines where the glyphs are no longer visible. A glyph resembling the Greek letter Psi is evident, as are two completed circles. The remaining forms are curvilinear abstractions which are not easily defined (Figure 5.16).

FIGURE 5.14
PETROGLYPHS, JM104
JOHN MARTIN RESERVOIR PROJECT

FIGURE 5.15
SCALED PETROGLYPH DRAWINGS - SITE JM 117, GROUP A
JOHN MARTIN RESERVOIR PROJECT

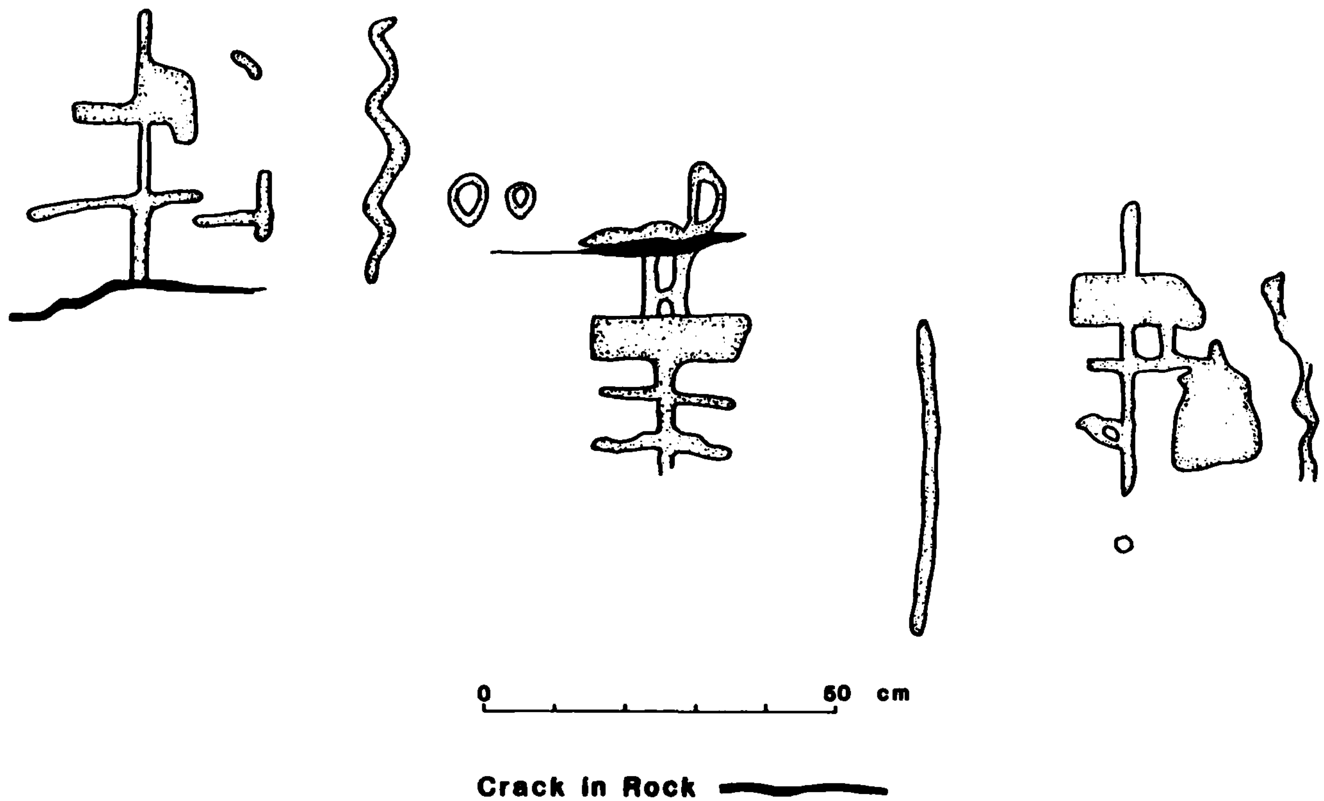
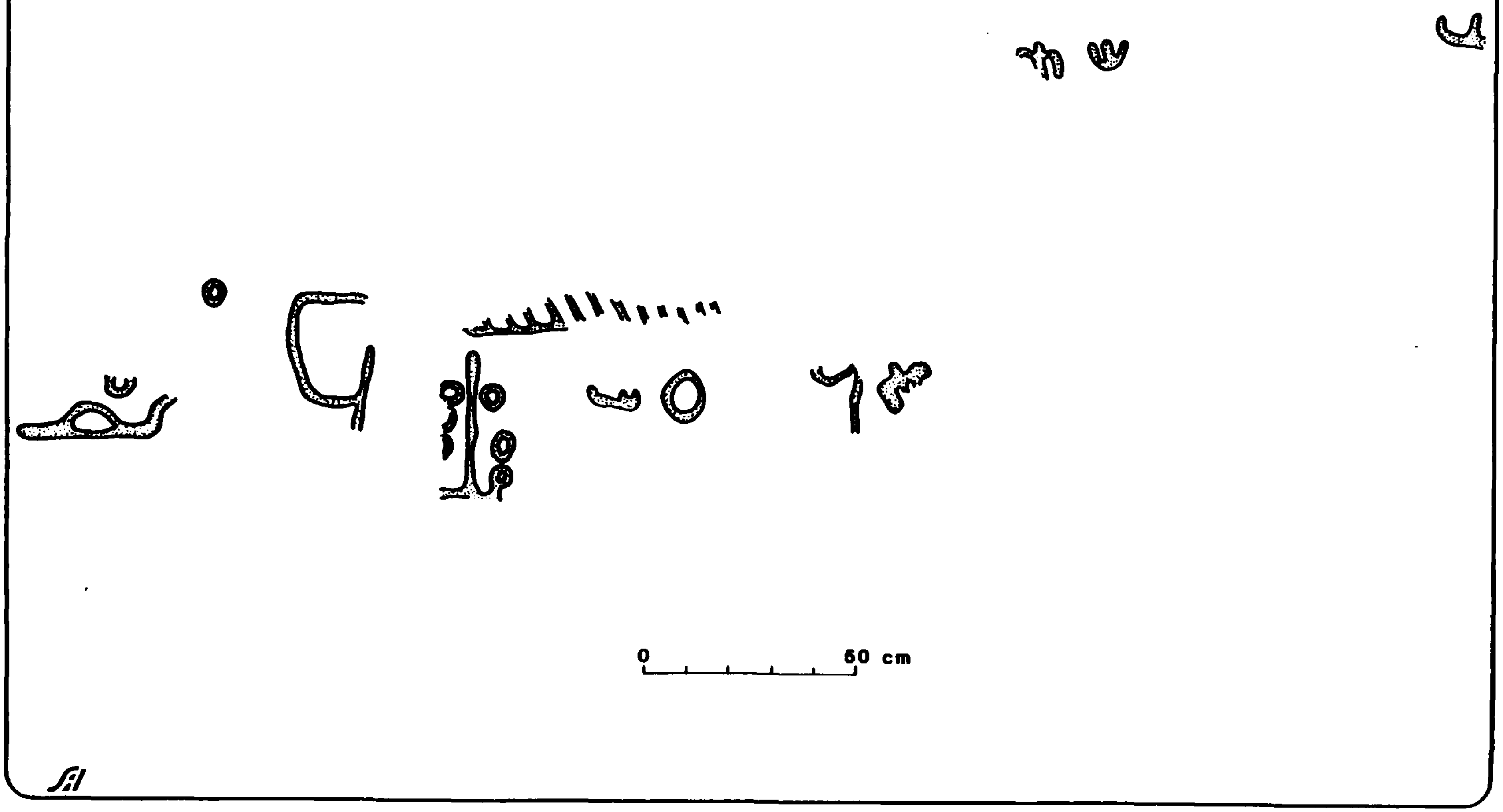


FIGURE 5.16
SCALED PETROGLYPH DRAWINGS - SITE JM 117, GROUP B
JOHN MARTIN RESERVOIR PROJECT



Petroglyphs of Group C are also greatly eroded. At the far west of the panel an incomplete figure resembles the foot and tail portion of a bird. Another Psi motif is represented. Directly north and west are two U-shaped elements. The remainder of the elements are unidentifiable (Figure 5.17).

Panel C-1 was located 2.5 m west of Group C and features a solidly pecked arch and three circles.

Groups D and E are faint and consist of highly eroded curvilinear abstractions (Figures 5.18 and 5.19).

5.5.4.3 JM128/5BN7

JM128/5BN7 is known as the Hicklin Springs site (Renaud 1936). It is located on the east bank of Rule Creek. The rock art is pecked into the vertical sandstone exposures along a 400 m section of the creek. Directly south is JM123/5BN103, a site which features a stone alignment. Pictographs were recorded at this site in 1971 by the University of Denver Archaeological Survey, although none were recorded by John Martin field crews.

A sampling of petroglyphs (Figure 5.20) was sketched of JM128/5BN7. The life forms are stiff, lack animation, and are formed by linear lines. The abstract forms consist of concentric circles, bisected circles, circles with radiating lines, rows of dots, and Psi-like elements. Zoomorphic figures represent animal tracks, deer, snake, and a full bodied bird or turtle figure. There is a front facing, sexually distinguished human figure with fingers widely spread. A circular structure resembling a dwelling is also depicted here.

Other abstract elements of spiraling circles, combinations of bisected circles, and various pinnate designs are evident.

Historic inscriptions in Cyrillic, English, and Spanish appear, along with a three-masted sailing ship.

CONCLUSIONS

The three petroglyph sites exhibit three distinct styles, although some common elements exist between JM104/5BN14 and JM128/5BN7. Each site has similarities in style with other petroglyphs of southeastern Colorado. No superimposition was recorded which could aid in estimating the age of the glyphs relative to one another.

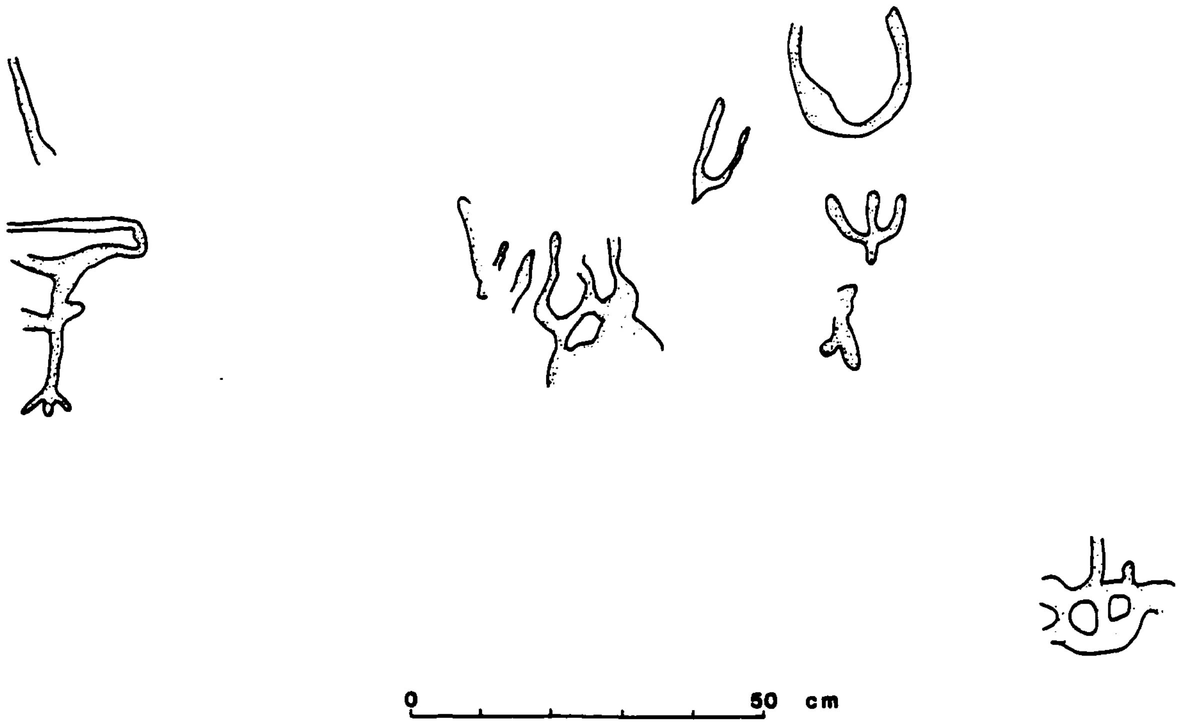
The incised, linear elements of JM 104/5BN14 are commonly found in petroglyphs of southeastern and southwestern Colorado. South of the project area, Hackberrry Springs (5LA1115) contains this style, which closely resembles JM104/5BN14. Stuart uses superimposition and differential patination to define three stylistic periods. Although unable to apply a time period, he places this style of slash marks as the most recent of the styles he identifies; that is, more recent than curvilinear abstractions or solidly pecked zoomorphs.

McKern (1978) refers to these as a "product of practical origin such as sharpening bone or antler implements." That these indentations could be related to "count registration" or "winter counts" is also suggested (McKern; Howard 1960). JM104/5BN14 shows evidence of use as a quarry and habitation site; therefore, it is plausible that the grooves were made for purposes of sharpening bone or antler tools, or as a form of tally marking. No debris was recovered directly below the glyphs as may be expected from use as tool sharpening.

The cultural affiliation of JM104/5BN14 is Late Plains Archaic based on the association of one projectile-point fragment. There is no direct indication from the rock art of the cultural

FIGURE 5.17
SCALED PETROGLYPH DRAWINGS - SITE JM117
JOHN MARTIN RESERVOIR PROJECT

GROUP C



GROUP C-1

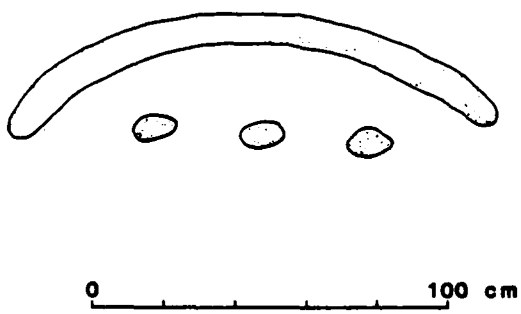


FIGURE 5.18
SCALED PETROGLYPH DRAWINGS - SITE JM117, GROUP D
JOHN MARTIN RESERVOIR PROJECT

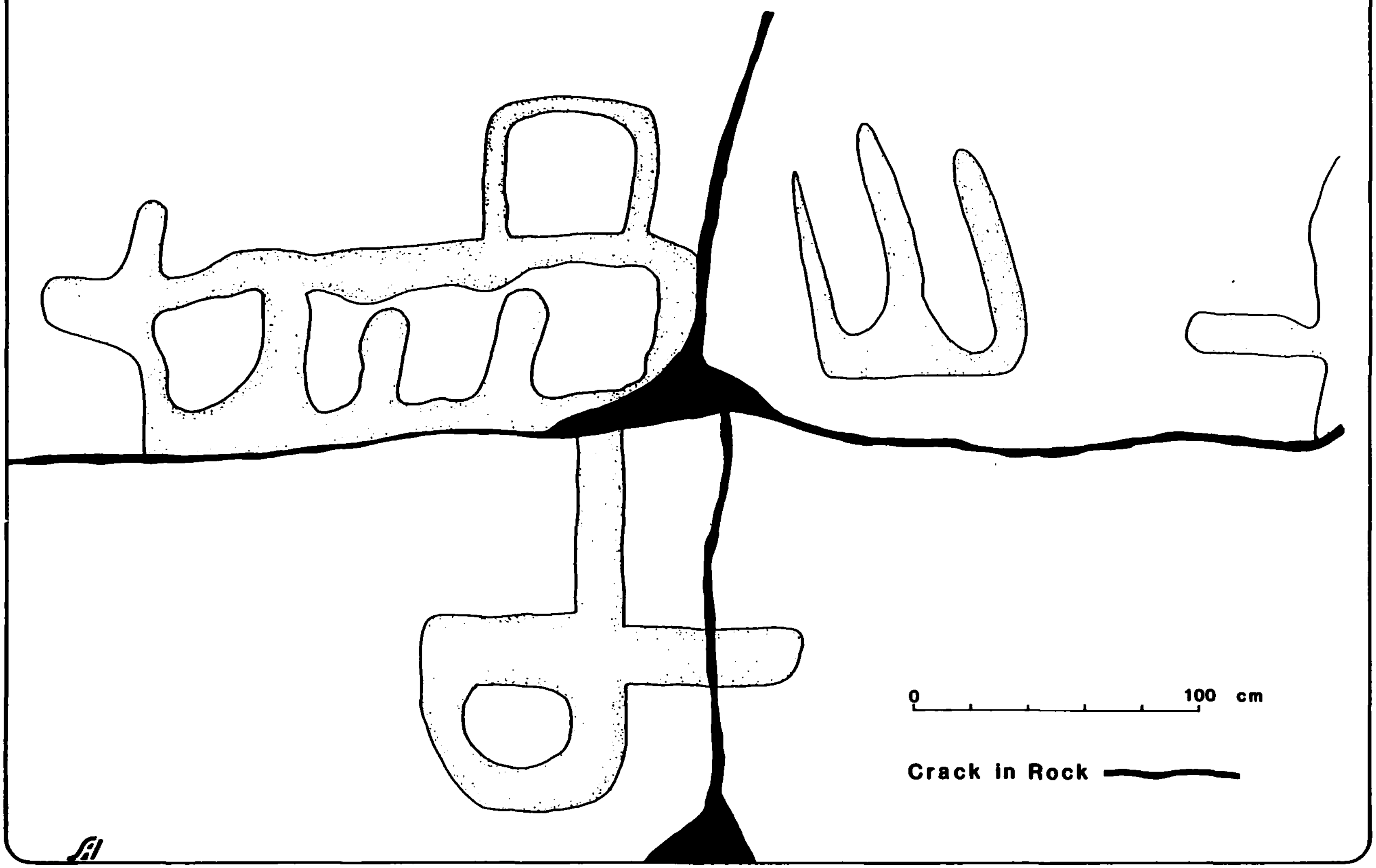


FIGURE 5.19
SCALED PETROGLYPH DRAWINGS - SITE JM117, GROUP E
JOHN MARTIN RESERVOIR PROJECT

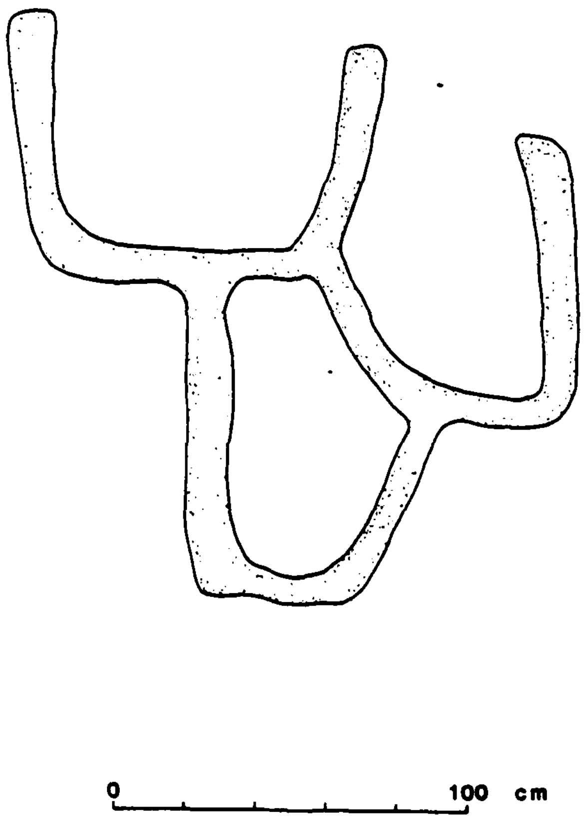
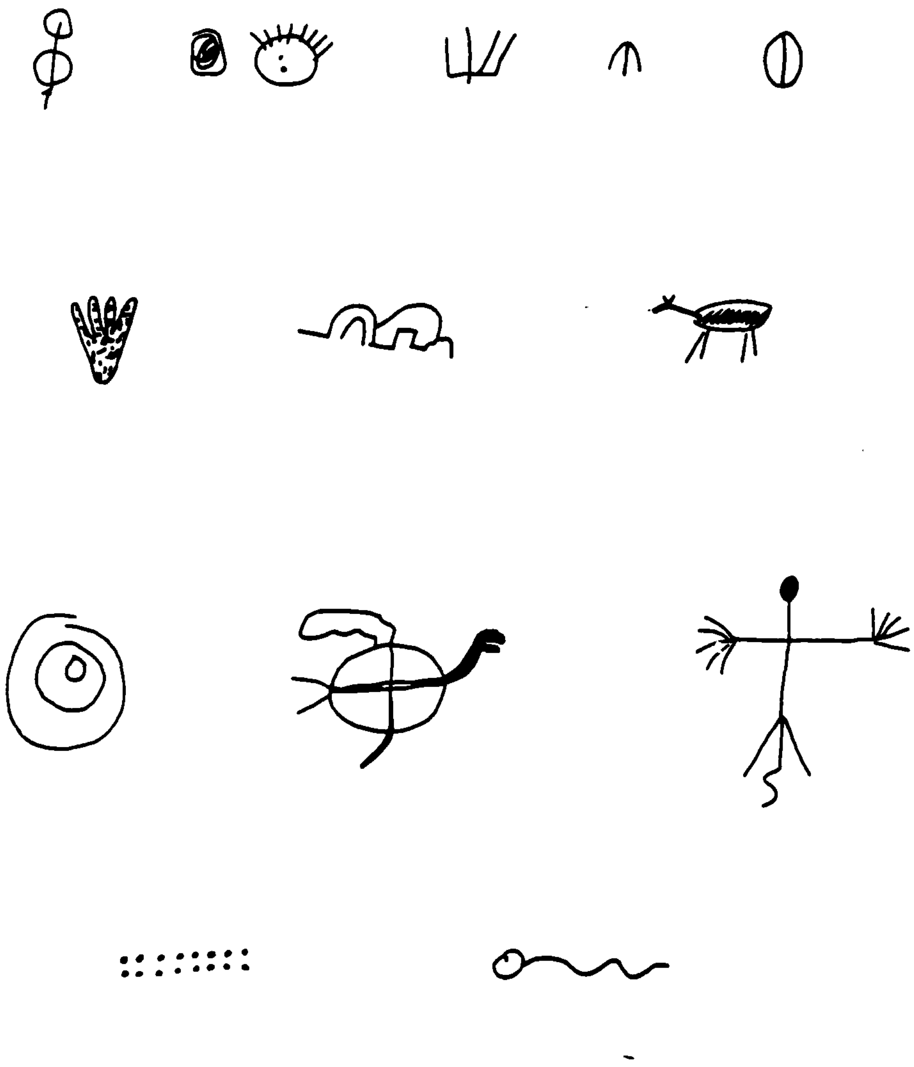


FIGURE 5.20
PETROGLYPH MOTIFS - SITE JM128/5BN117
JOHN MARTIN RESERVOIR PROJECT



contact of the art maker.

The rock art of JM117/5BN122 is referred to as curvilinear abstract art. It is made of curvilinear and rectilinear variants produced repeatedly or in various combinations. The only nonrepresentational glyph is the partial bird figure in Group C.

The style of JM117/5BN122 is similar to Buckles' 5PW2 site. The circular and linear elements are common to both. The vertical, crossed-lined elements are also common to both. In a comparative analysis of the rock art of 5PW2, Buckles states, "that it is similar to rock art styles from elsewhere which consistently have been considered to be the oldest rock arts over a broad area of the western United States...5PW2 is extremely important in temporal and art element definitions of the style because it is securely dated prior to A.D. 100 and the rock art of the site is not intermixed with later and different art." Based on the similarities of style of *JM117/5BN122 and 5PW2, the petroglyphs of* JM117/5BN122 could be the oldest feature of the site.

There are no identifiable characteristics of the glyphs of JM117/5BN122 which indicate a specific cultural context. Buckles states that the curvilinear abstract art styles are productions of Archaic hunting and gathering peoples widely distributed from the Great Basin to the Plains.

To evaluate the glyphs in terms of function is, as with most rock art, speculative. Again, Buckles proposed various approaches to this; one of which is a graphic symbol system, and another is the relationship of art to supernaturalism.

JM128/5BN7, also known as the Hicklin Springs site, contains a large number of petroglyphs ranging from prehistoric to historic periods.

The concentric circles, parallel rows of dots, and bisected circles are elements found in curvilinear abstract art, indicating these as the oldest elements of the glyphs.

The full-bodied zoomorphic forms with line legs and filled in heads correspond to Non-Historic Life Forms Style 2 (Buckles 1971). Prevalent also in Style 2 are distinctive horns and antlers as demonstrated in the deer-like motif of JM128.

The human figures appearing in Figure 3 has traits which apply to Style 2: it is front facing, fairly immobile, and has arms widely spread in a "surrender" position.

The historic inscriptions date to 1880 as inscribed.

A possible function of the representational art was simply to mirror what was there as in a housing structure or animal. Other functions could pertain to hunting or fertility as is *illustrated* by the animal tracks or the human figure.

The glyphs of JM128 were found without associated artifacts. The various styles suggest the area was used by more than one culture.

5.6 NRHP TESTING OF SITES

In order to make recommendations to the COE concerning the potential of archeological sites for nomination to the NRHP, it was occasionally necessary to put in small test squares for determination of depth of cultural deposits. This was done in order to evaluate the integrity of the cultural resources and to gain information on stratigraphy and age of both natural and cultural layers. On the John Martin Reservoir project, we were directed to test excavate only where there was some likelihood of finding intact subsurface deposits. Since most of the sites were found on geologi-

cally old land surfaces, as described in Section 12.0. evaluation could often be made without resort to testing. However, three sites were deemed suitable for testing due to the potential for subsurface depth. These are JM081, JM124, and JM132. The first site is a small rockshelter located on the north bank of the Arkansas, while the other two are surface exposures recorded along Rule Creek. Each of these sites is described and evaluated for potential NRHP significance in this appendix according to the criterion of 36CFR 60.6(d).

5.6.1 JM081 (5BN206)

This site is a small rockshelter located on the north side of the reservoir on the tip of a ridge (T22S, R51W, Sec. 35, PM6) near the former site of the New Bent's Fort historical marker. It is situated about 50 m above the Arkansas River and its alluvial floodplain. A terrace edge separates an alluvial surface just beneath the overhang from the lower level of the modern river bottomland.

The shelter is a south-facing overhang eroded from the Dakota sandstone and is about 20 m long (east-west) and 10 m deep (north-south). Remains of a dry-laid masonry wall of unshaped sandstone blocks are located in a semicircular arc around the open, central portion of the shelter. The two crescentic ends of the arching wall are abutted to the back bedrock of the shelter, the wall bows convexly to a point just under the shelter dripline.

Small amounts of stone flakes, bone, and burnt debris are present on the surface. One potsherd was recovered from the surface during the survey recording (Section 5.3). Furthermore, the roof of the shelter has eroded and collapsed. Evidence of burning is present on these fallen ceiling slabs.

Based on these observations of surface artifacts and the potential for some stratified depth, the field crew recommended a followup program of test excavation. The recommendation was enhanced when a masonry wall was found since so little architectural evidence has been encountered within the project area despite the potential known from Woodland, Apishapa, and Terminal Prehistoric remains recorded on the nearby Chaquaqua Plateau (Figure 4.1).

On October 6, 1980, T. Reid Farmer, with the assistance of two crew members, spent one day excavating a 1-by-1 m square test pit. The leaving of balks actually reduced the effective area of excavation to 0.49 m^2 as shown on profile, Figure 5.21. The pit was placed within the arc of the masonry wall near the back wall of the shelter. Digging proceeded in 10-cm arbitrary levels from the modern ground surface down to the bedrock floor of the overhang. Each arbitrary level was dry screened through a 7-mm (¼") mesh sieve for recovery of artifacts and ecofacts. The deposits were found to be quite rich with much evidence of hearths (charcoal and oxidized sandstone hearth rock) and portable artifacts (stone flakes, potsherds, and animal bone fragments, some of which are burned). Figure 5.21 shows the plan and profile of the test pit. The plan is depicted with irregular bedrock at depths ranging between 26-42 cm where it sloped down toward the opening of the shelter. One possible stone-lined hearth was found in the southeast corner of the test pit, in Level 2.

Figure 5.21 illustrates the profile of the deposits taken from the west face of the test pit. Four different strata are definable. A top 10-cm unit of loose, gray silty topsoil contains roof fall slabs aplit from the ceiling of the shelter. Fifteen cm of brown silt underlie the topsoil which in turn is preceeded by 5 cm of fine sand. The bottommost layer is a 15-cm thick deposit of gray loam resting on the sloping surface of bedrock. Artifactual material is distributed throughout this profile.

FIGURE 5.21
TEST EXCAVATION - JM081
JOHN MARTIN RESERVOIR PROJECT

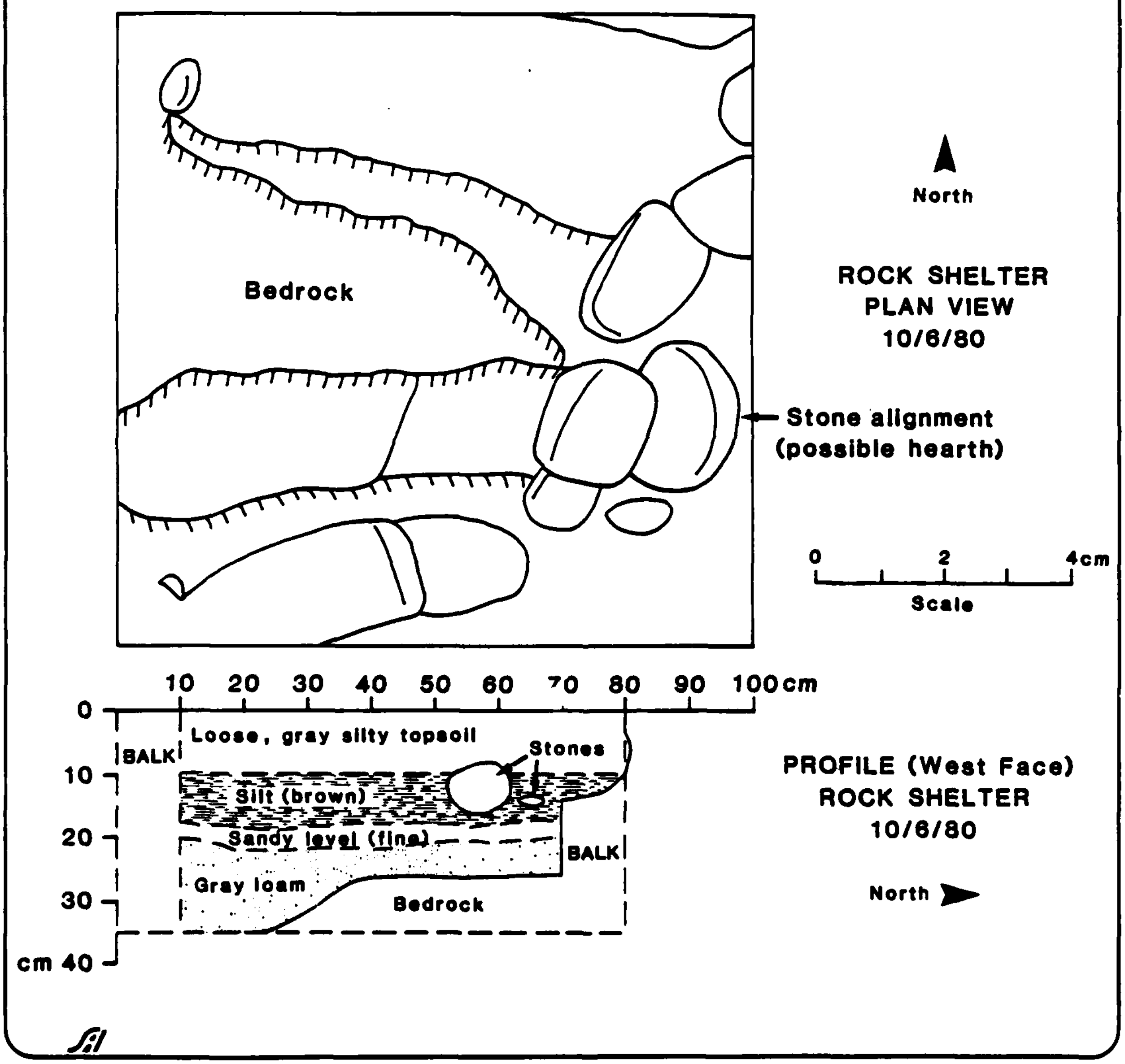


Figure 5.22 is a histogram plot showing the level by level distribution of the major artifact classes. The graph values show that very little artifactual material was found on the modern surface of the rock shelter. However, large numbers of lithic flakes, burned and unburned scraps of animal bone, and other miscellaneous categories of artifacts were screened from Level 1, the loose, gray silty topsoil. Particularly revealing was the recovery of small burned pieces of clay daub or construction clay in this layer. Judging from this evidence, the surface exposed stone-walled house was partially constructed of frame and mud. After abandonment, this combustible superstructure burned, baking the clay daub, and forming the Level 1 house fill. The pieces of pottery are cord-marked sherds not assignable to any particular focus of the Formative stage.

In general, the distribution of prehistoric artifact classes is fairly uniform only dropping off in Level 4 (Figure 5.22). The increase in animal bone scrap shown in Level 2 may well reflect the butchering and cooking of game. The bone consists of a mixture of spiral fractured pieces broken while the bone was still green, perhaps to extract the marrow. The cooking interpretation is further supported by the presence of the possible hearth located in the southeast corner of the test pit, Level 2 (Figure 5.21) Other bones are whole elements of small rodents or rabbits. One rodent skull attests to the churning action of burrowing animals leading to mixing of these pre-house deposits.

The large amount of cultural materials recovered, the evidence of architectural features, and hearths shows that this site does have great potential for archeological data recovery. It would appear to meet the criterion for significance outlined by 36CRF60.6(d) in that it has demonstrated scientific value for research problems of chronology, environmental reconstruction, Formative (A.D. 250-1300) life-way reconstruction, and study of evolutionary processes.

5.6.2 JM124 (5BN246)

On the east side of Rule Creek is a one-room residence formed by an arc-shaped wall of upright sandstone slabs. The arc abuts the Dakota sandstone cliff on this side of the Rule Creek to create a D-shaped structure. The distance between the wall abutments is 11 m in length while the maximum bow of the curved wall is 8 m out from the cliff (Figure 5.23). A second questionable room is located just to the north, also on the alluvial floodplain of Rule Creek (T23S, R50W, Sec. 19). The curving wall alignments at this site appear very similar to those found within the rock shelter of JM081. This similarity may be due to contemporaneity of occupation. Housing of this nature is likely to be of a Formative age, dating sometime in the Woodland, Apishapa, or Terminal Prehistoric age (Figure 4.1).

After the survey crew encountered the site in early September, it recommended subsurface testing in order to learn more about the nature of the site. Particularly puzzling was the general lack of surface artifacts; only one Secondary utilized basalt flake having been found. Further, it was hoped to determine if the well-defined house had a floor and, if so, what would be the artifactual assemblage found on this surface?

Accordingly, on September 18, T. Reid Farmer and two crew members excavated a single 1 by 1 m test pit within the structure and located toward the outer perimeter of the wall (Figure 5.23). The excavations were taken down in 10-cm measured levels to a depth of 50 cm. The contents of each arbitrary level were recovered by dry sieving through a 7-mm (¼") mesh shaker screen. Results of the test excavations revealed a cultural layer at a depth between 10-20 cm below the present ground surface. This deposit contains numerous charcoal flecks

FIGURE 5.22
HISTOGRAM PLOT OF MAJOR ARTIFACT CLASSES BY TEST EXCAVATION LEVEL, JM081
JOHN MARTIN RESERVOIR PROJECT

	ARTIFACT CLASSES							
DEPTH	LITHIC FLAKES	ANIMAL BONE SCRAP	CHARCOAL FRAGMENTS	CLAY DAUB	POTSHERDS	GLASS	NAILS	TOTALS
SURFACE	1	1						2
LEVEL 1 0 - 10 cm	20	46	2	3	2	6	1	80
LEVEL 2 10 - 20 cm	29	94	18			1	1	143
LEVEL 3 20 - 30 cm	29	44	25		1			99
LEVEL 4 30 - 40 cm	12	13	2					27
TOTALS	91	198	47	3	3	7	2	351

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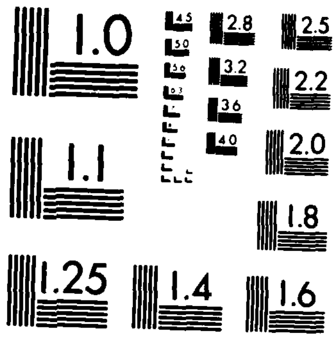
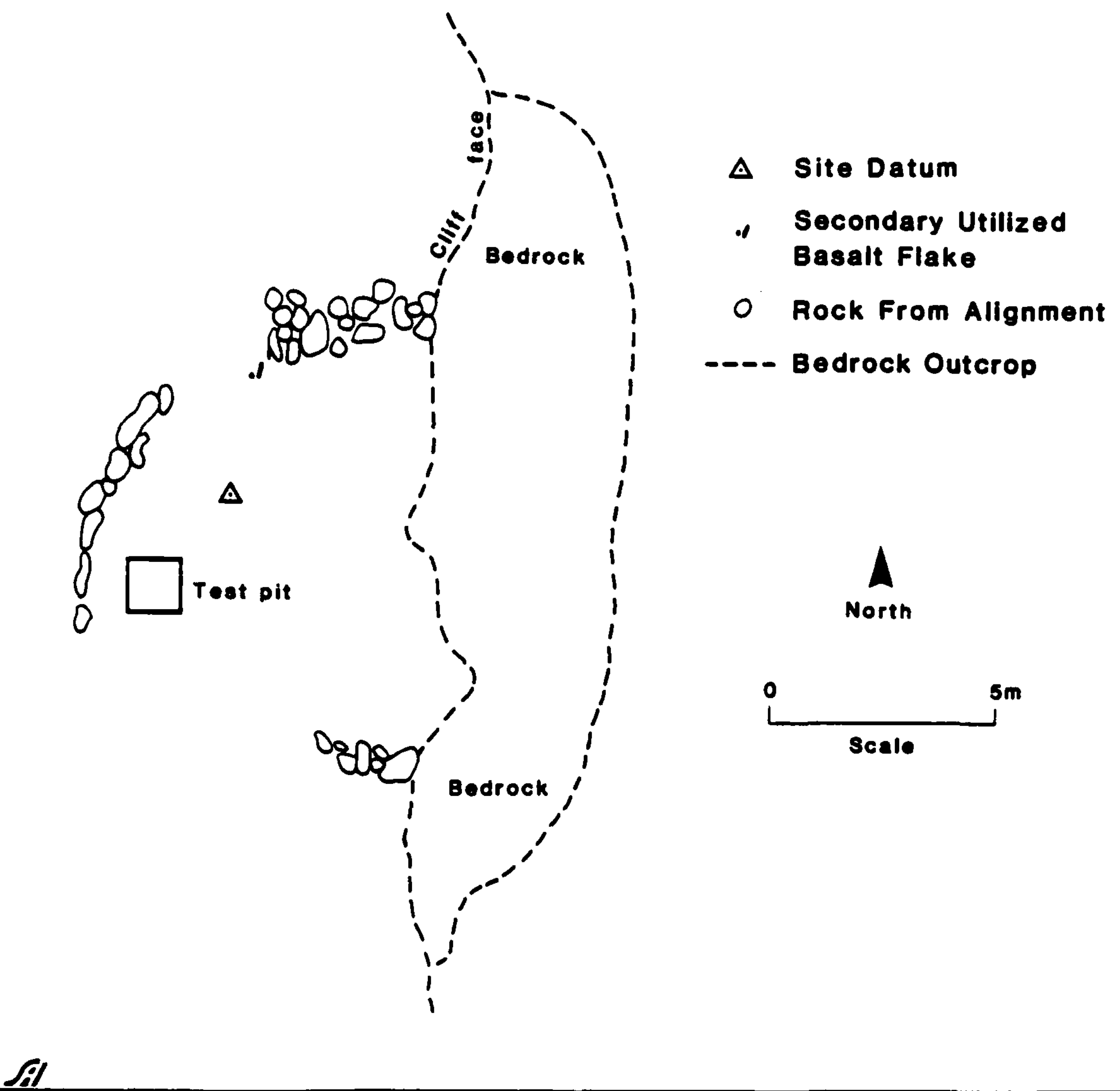


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FIGURE 5.23
PLAN OF D-SHAPED STRUCTURE
SHOWING LOCATION OF THE CLIFF FACE AND TEST PIT, JM124
JOHN MARTIN RESERVOIR PROJECT



and animal bone—both burned and unburned--scraps, but no artifacts. A single land snail was also recovered from this horizon. It is likely that this zone represents the house floor with food remains and living debris accumulated at the time of occupation. However, the results of testing still leave open the question as to the age of the house since neither dateable projectile points nor potsherds were recovered. Since the surface 10-cm level was devoid of any occupational evidence, it would appear to be a unit of sediment washed into the house after occupation. Similarly those excavation levels between 20-50 cm depth were also lacking in artifacts and other evidence of human occupation leading Farmer to terminate the testing operation.

The profile of the test pit wall was not drawn due to the fact that there was little change in either soil texture or color. Further, the sediments were not subdivided into visible layers. Farmer did observe a mild gradational change in soil texture between the top 24 cm of sandy loam which became a finer soil approximating a silty loam at depth.

In conclusion, although not all of the research questions posed before testing can now be answered, we have verified the residential use of the structure, based on the presence of a buried floor with food remains and evidence for the burning of fires, probably hearth cooking. However, we are still uncertain as to the exact date of the house although it is likely of Formative age (A.D. 250-1300).

5.6.3 JM132 (5BN252)

This base camp, classified as Functional Site Type 6.2 in Section 6.1 of this report, consists of 38,640 m^2 of post-Woodland age (after A.D. 1000), stone tools, flaking debris, and fire hearths scattered over the surface of the Rule Creek floodplain. The site is located on the upper reach of the creek on the right bank just at the base of a sandstone butte. JM132 lies directly east of JM124 at a distance of 0.52 km in T32S, R50W, Sec. 19. Modern erosion at JM132 has cut a deep gully through the sediments where the floodplain forms a junction with the sandstone cliff. This entrenchment has exposed the mouth of a buried rock shelter which does not appear to contain artifacts of human manufacture. During the course of recording JM132 on September 15, 1980, the field crew thought that they could detect the presence of buried artifacts and a hearth exposed in the gully walls at depths ranging up to 2 m. Because the site was thought to be one of the few buried components in the study area and has burned bone, mussel shell, and ceramics in addition to lithic artifacts and hearths, it was recommended for testing in order to evaluate its significance for the NRHP.

On the afternoon of October 6, 1980, T. Reid Farmer and two crew members began a 1-by-1 m test pit located on the extreme north edge of the surface lithic scatter. The pit was dug from the floodplain surface on the edge of the gully and 4 m west of the cliff face. Work was resumed on the morning of October 7, 1980. Excavations were carried down in arbitrary 10-cm levels measured below ground surface. Digging proceeded through a hard clay to a depth of 45 cm at which time the controlled excavations were terminated. A number of artifacts were recovered from the top 15 cm or so of the excavation but after a depth of 20 cm, the artifact recovery fell to zero. There is a poorly developed soil here with a very hard and compact red loam clay that is culturally sterile (devoid of artifacts) underlying the artifact-bearing stratum.

To further check the conclusion that artifacts do not extend to any depth into the floodplain alluvium, Farmer next cleared a profile against the exposed face of the nearby gully and this showed no cultural strata in the 1-m depth

below the reach of the test pit (.45 to 1.45 cm below surface). From these observations, Farmer concluded that the site is basically a surface manifestation where artifacts have washed down a slope giving the illusion of depth. Based on these findings, JM132 is not considered significant to the NRHP as a separate recommendation. However, in company with the other 111 prehistoric sites found in the John Martin Reservoir area, it does contribute to the block of sites recommended as a NRHP District (Section 11.0).

5.6.4 CONCLUSIONS

Of the three sites test excavated, subsurface cultural deposits were defined at JM081 and JM124, while JM132 was shown to be a surface distribution of artifacts. The rock shelter, JM081, has a Formative age house on the surface with house contents being distributed through Level 1 of the test pit. Formative age deposits of Woodland, Apishapa, and Terminal Prehistoric affiliations likely extend at least into Level 3, 20-30 cm, to judge from the presence of one cord-marked potsherd at this depth. Some prehistoric artifacts extend into Level 4, but as the bedrock floor of the shelter is approached, the artifact density begins to fall suggesting a lighter intensity of occupation, at least in this portion of the overhang.

JM124 is a residential house, likely of the same Formative age as JM081. The structure is constructed in much the same manner but the D-shaped wall is an open house rather than one placed within an overhang. At JM124, the arc-shaped house wall is abutted to a sandstone cliff face. Testing within the house perimeter revealed an occupational zone between 10-20 cm below the modern surface. This layer of spirally fractured animal bone and charcoal is likely the kitchen leavings associated with the house floor although this surface was not actually defined during the course of the test excavation.

Judging from this testing evidence, both sites JM081 and JM124 have buried deposits displaying integrity. For this reason, both meet the requirements for recommendation to the NRHP in that they have yielded and are likely to yield much more scientific evidence of value to the regional prehistory of southeastern Colorado (36CRF60.6(d). In contrast, the surface scatter of stone artifacts and hearths comprising JM132 does not appear to meet the requirements of 36CFR60.6(d) except as this site does contribute to the integrity of the larger district recommendation.

5.7 UNIQUE SITES

In addition to these generalized statements about the majority of prehistoric sites, several archeological sites are absolutely unique in their characteristics. These are briefly described here without attempting to enter them in the computer data file for statistical treatment.

5.7.1 JM022 (5BN156)

One such site is JM022 (5BN156), which is a unique cache of retouched and utilized flake blades made of alibates and obsidian located on the north bank of the Arkansas and upstream from the damsite. This group of 15 specimens (field numbers 3 through 17) was found on a sandstone outcrop and covered by a sandstone boulder as if purposefully hidden in anticipation of recovery in the future. In addition, 13 other stone tools were scattered on the surface of the Dakota sandstone outcrop, closely grouped around the covered cache. A detailed description of the individual cache specimens is provided in Section 5.3 with selected specimens illustrated on Figure 5.7. The importance of this find, in addition to the evidence for temporary storage, is the valuable record of long distance lithic trade. The artifact attributes do not allow age assignment.

5.7.2 JM030 (5BN164)

Another unique archeological site is JM030 (5BN164), a set of three stone tipi rings measuring 2.0 to 2.5 m. in diameter. These rings are also located on the north bank of the Arkansas River just upstream from the dam abutment. Each circle is composed of between 38 and 49 river cobbles dry-laid in a single course, one-stone-wide alignment. Although no stone tools or debitage were found in association, the style of the rings strongly suggests a proto-historic age.

5.7.3 JM123 (5BN245)

And finally a base camp, Functional Site Type 6.0, has a unique alignment of rocks thought by by the field crew to be a sighting device. This site, JM123 (5BN245), is a large lithic scatter found on a knoll located on the east bank of upper Rule Creek. The sighting device consists of eight standing rocks positioned in four pairs. A sight down the axis of this north-south alignment reveals a single standing rock as a northern foresight. However to actually prove an astronomical sighting function, it would be necessary to observe the rising and setting of stars or other astronomical phenomena by means of a theodolite.

A single early Archaic projectile point was collected off of this site.

5.8 SUMMARY

The prehistoric data is briefly summarized as a series of different combinations of lithic artifact scattters found either in the open or in rock shelter overhangs. Occasionally other kinds of artifacts were found, including potsherds, fire hearths, scattered hearthstones and/or dry-laid masonry walls. Other sites consist of rock art incised on the face of sandstone cliff outcrops. In addition, three unique sites were described including: a cache of retouched and utilized flake blades (JM022), a set of three tipi rings (JM030), and a base camp with stone alignment sighting device (JM123). Details of the individual sites are listed on Table 5.1.

Another means of describing the survey data base is in terms of 50 artifact variables. These numbered variables will be employed in Section 6.1 in the construction of a functional site typology by means of the NTSYS computer program. The data base as a whole will be employed in Section 6.5 for the testing and evaluation of the hypotheses.

SECTION 6.0
ANALYSIS AND EVALUATION OF PREHISTORIC HYPOTHESES

by Frank W. Eddy and Richard E. Oberlin

In this section we will present the results of the various statistical procedures described in Section 4.3.3. The results of these computer analyses are organized in terms of a series of research themes having to do with subsistence and settlement variability. Among these topics are: 1) site type definitions, 2) factors affecting selection of site location, 3) definition of intrasite task/activity areas, and 4) intersite task/activity areas. Having treated these formal and spatial dimensions, it will then be possible to evaluate the various research hypotheses of Section 4.3.2.

6.1 DEFINITION OF SITE TYPES

Site types of functional significance are defined here using two approaches: bivariate analysis and NTSYS. The bivariate treatment of the data has been used to perform a first-order modeling of two settlement types as schematically diagrammed on Figure 6.2. This model of functional site types and their organization on the landscape is further refined as a second-order approximation by means of a multivariate analysis based on the NTSYS programs. The second-order results are mapped on Figure 6.7 where the actual geographical positioning of base camps and special-activity sites are mapped with postulated transhumant linkages shown.

6.1.1 BIVARIATE ANALYSES OF SITE TYPES

Of the many hundred Scattergram programs run on interval level data (Figure 6.1), 53 pairs of variables showed significant Pearson R correlations at a probability level of 0.05 or less (Table 6.1). This large block of data is sufficient to construct an empirical model of site types and their distribution over the landscape as schematically represented on Figure 6.2. The other bivariate programs (NONPAR CORR, CROSSTABS), with lesser numbers of significant variable pairings, can then be interpreted and details added to the construction of the empirical model.

The construction of the bivariate Scattergram model is founded on an assumption to the effect that "variables which are significantly correlated to a third variable are also related to one another." In this way, a network of interrelated variables can be assembled to provide an attribute description of two kinds of generalized site types: base camps and special-activity sites (Figure 6.1). The defining attributes (Site Variables and Onsite Artifact variables) can be seen as a response to two dimensions of change. At right angles to the Arkansas River, spatial variation is measurable in terms of Site Elevation (VAR12), Height Above the *Arkansas River (VAR16), and Distance* to the Arkansas River (VAR15). A second dimension of change is expressed along an axis paralleling the river. Here three variables were designed to measure change along an axis from SCS range site boundary to the center of each site habitats. These ecotone-centrality measures include Distance to Edge of Range Site, VAR17, Percent of Dominant Range Site, VAR18, and Number of Range Sites, VAR19. Other variables, such as site size, artifact density, artifact diversity, and the frequency of artifact types, can be seen as a causal result of prehistoric decisions to locate task activities according to these two dimensions of change.

An interpretation of Figure 6.2 is that prehistoric peoples made choices to locate their base camps at low elevations close to the Arkansas River but at some distance from intermittent drainages. Here, riparian riverside resources were optimized at the expense of upland game and vegetal products.

FIGURE 6.1 LIST OF VARIABLES DEFINING THE TWO SITE TYPES COMPRISING THE BIVARIATE SCATTERGRAM MODEL

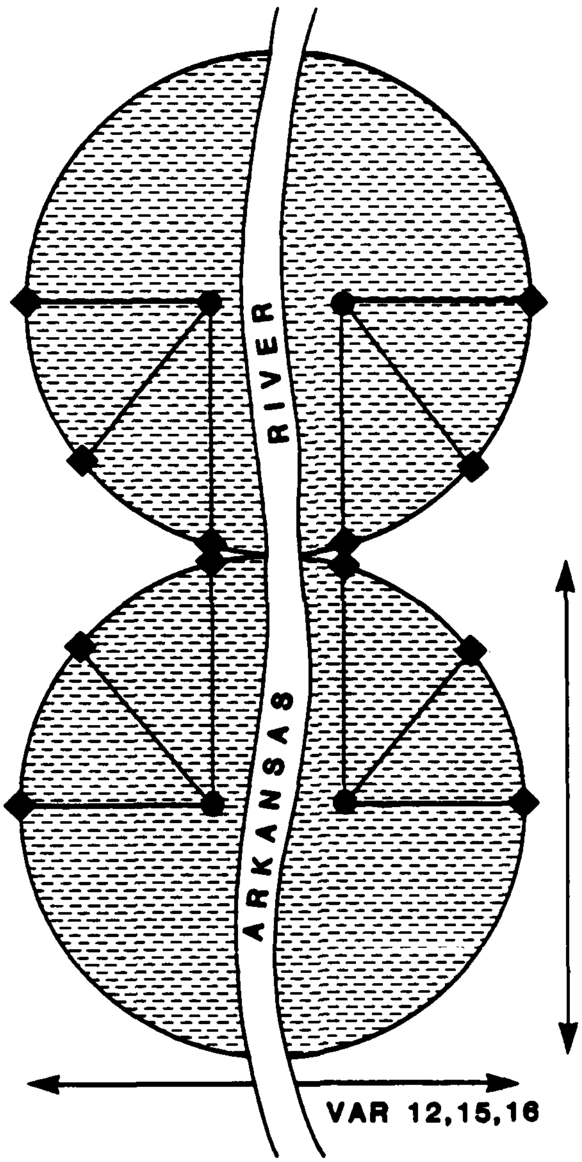
BASE CAMPS

VAR12: Site Elevation (low)
VAR13: Distance to Nearest Intermittant Drainage (high)
VAR15: Distance to Arkansas (small)
VAR16: Height Above Arkansas (low)
VAR17: Distance to Edge of Range Site (high)
VAR18: Percentage of Dominant Range Site (large)
VAR19: Number of Range Sites in a One Kilometer Circle (low)
VAR20: Standing Crop Yield (high)
VAR31: Number of Hearths (high)
VAR33: Site Size (large)
VAR34: Artifact Diversity (maximum number of types)
VAR39: Hammer Percentage (high)
VAR47: Metate Percentage (high)
VAR48: Mano Percentage (high)
VAR52: Tertiary Flake Percentage (high)
VAR58: Unclassified Ground Stone Tool Percentage (high)

SPECIAL-ACTIVITY SITES

VAR12: Site Elevation (high)
VAR13: Distance to Nearest Intermittant Drainage (low)
VAR15: Distance to Arkansas (great)
VAR16: Height Above Arkansas (high)
VAR17: Distance to Edge of Range Site (low)
VAR18: Percentage of Dominant Range Site (low)
VAR19: Number of Range Sites in a One Kilometer Circle (high)
VAR36: Site Density in One Kilometer Circle (high)
VAR37: Site Density in Three Kilometer Circle (high)
VAR38: Chopper Percentage (high)
VAR40: Scraper Percentage (high)
VAR41: Biface Percentage (high)
VAR42: Projectile Point Percentage (high)
VAR45: Utilized Flake Percentage (high)
VAR49: Core Percentage (high)
VAR50: Primary Flake Percentage (high)
VAR51: Secondary Flake Percentage (high)
VAR56: Miscellaneous Core Tool Percentage (high)

FIGURE 6.2
SCHEMATIC DIAGRAM OF FIRST ORDER SETTLEMENT MODELING
JOHN MARTIN RESERVOIR PROJECT



Range Sites	12-Elevation	17-Distance to Edge of Range Site
Special Activity Sites	15-Height Above Arkansas River	18-Percent of Dominant Range Site
Base Camps	16-Distance to Arkansas River	19-Number of Range Sites

TABLE 6.1

LIST OF SIGNIFICANTLY CORRELATED SCATTERGRAM VARIABLES

Var.	Name	Var.	Name	Corr. (R)	N	Alpha
31	Hearths	16	Ht. Ark.	-0.52378	22	0.01235
31	Hearths	19	No. Rang.	0.48982	22	0.02067
33	Site Size	9	Slope	0.39043	93	0.00011
33	Site Size	13	Dist. Int.	0.38203	98	0.00010
34	Art Div.	13	Dist. Int.	0.42204	98	0.00002
34	Art Div.	17	Edge Ran.	0.21516	94	0.03729
36	Site Den.	16	Ht. Ark.	0.31913	99	0.00128
36	Site Den.	17	Edge Rang.	0.24964	94	0.01525
36	Site Den.	19	No. Rang.	0.23615	99	0.01861
37	Site Den.	16	Ht. Ark.	0.45270	99	0.00001
37	Site Den.	17	Edge Rang.	-0.28161	93	0.00497
37	Site Den.	18	Dom. Rang.	0.19012	99	0.05945
31	Hearths	40	Scrapers	-0.47163	18	0.04816
33	Site Size	45	Util. Flake	-0.36411	86	0.00057
33	Site Size	52	Ter. Flake	0.22723	82	0.04007
34	Art. Diver.	38	Chopper	-0.25731	59	0.04914
34	Art. Diver.	40	Scraper	-0.26493	80	0.01755
34	Art. Diver.	41	Biface	-0.53217	47	0.00012
34	Art. Diver.	42	Proj. Pt.	-0.72554	10	0.01755
34	Art. Diver.	45	Util. Fl.	-0.34871	86	0.00100
34	Art. Diver.	49	Core	-0.23315	95	0.02298
34	Art. Diver.	50	Prim. Fl.	-0.29592	73	0.01102
34	Art. Diver.	51	Second Fl.	-0.25166	78	0.02624
35	Art. Densit.	49	Core	0.28420	94	0.00550
36	Site Den.	45	Util. Fl.	0.20539	86	0.05781
36	Site Den.	55	Uncl. Fl.	0.43771	21	0.04721
36	Site Den.	56	Misc. Core	0.39912	40	0.01073
37	Site Den.	38	Chopper	0.47904	59	0.00012
37	Site Den.	39	Hammer	-0.33449	48	0.02014

Table 6.1 - Continued

37	Site Den.	45	Util Fl.	0.50610	86	0.00001
37	Site Den.	51	Second Fl.	0.31722	78	0.00466
37	Site Den.	56	Misc. Core	0.53780	40	0.00035
39	Hammer	17	Dist. Rang	0.43268	46	0.00267
42	Proj. Pt.	18	Dom. Rang	-0.65105	10	0.04146
45	Util. Fl.	9	Slope	-0.28103	80	0.01157
45	Util. Fl.	10	Slope	-0.22389	86	0.03824
45	Util. Fl.	13	Interm. Dr.	-0.21092	85	0.05266
45	Util. Fl.	16	Ht. Ark.	0.33332	86	0.00171
45	Util. Fl.	17	Edge Rang.	-0.28376	81	0.01025
45	Util. Fl.	19	No. Rang.	-0.22181	86	0 04012
47	Metate	12	Elevat.	-0.41874	27	0.02971
47	Metate	17	Edge Rang	0.41479	26	0.03512
47	Metate	20	Crop Yield	0.52087	27	0.00534
48	Mano	12	Elev.	-0.43938	27	0.02184
48	Mano	16	Ht. Ark.	-0.38100	27	0.04991
48	Mano	20	Stand. Cr.	0.43250	27	0.02425
49	Core	9	Slope	0.28857	90	0.00581
52	Ter. Fl.	10	Slope	0.32454	82	0.00293
52	Ter. Fl.	15	Dist. Ark.	-0.21257	81	0.05676
52	Ter. Fl.	16	Ht. Ark.	-0.30224	82	0.00578
56	Misc. Core	16	Ht. Ark.	0.50627	40	0.00086
56	Misc. Core	17	Edge Rang	-0.38475	39	0.01559
58	Unc. Grd.	20	Stand. Cr.	0.52259	22	0.01259

Further, base camps are centrally located with regard to productive natural habitats (SCS range sites) as expressed by the fact that the distance to range site edge is large, the percentage of dominant range site is large, and the number of range sites within a 1-km circle is low.

Site attributes of base camps include the fact that they are large in size, have a large number of fire hearths, and a large number of artifact types.

In general the count of artifact types on base camps is larger than it is for special-activity sites suggesting a wide range of task-activities. However, those tool types which show significant correlation with base camp attributes are milling tools(VAR47, 48, and 59) and stone-tool finishing and repair(VAR 52,39). The metates, manos, and unclassified ground stone tools are found at low elevation near the river, far from the edge of range sites, and associated with habitats having a high standing crop yield (VAR20). It is here that the large-seeded grasses predominate, and these were collected and processed from base camps rather than from temporary special-activity camps. Similarly, stonetool finishing and repair was conducted at base camps rather than at special-activity lithic procurement camps as indicated by the fact that hammers and tertiary flakes (VAR 39,52) are found close to the river.

By way of contrast, special-activity sites (fly camps) are located high above the river back on the Pleistocene terraces away from the floodplain. Here, where water is scarce, the special-activity sites were positioned near intermittent drainages. Other locational choices showed a favoring of range site edges as measured by VAR17, 18, and 19. It is clear that the multiple resource options provided by the conjunction of two or more range sites were actively sought.

Special-activity sites are small in size, low in tool type count, have few hearths, and are high in site density (VAR36, 37). These sites contain specialized tools for processing vegetal and game resources, including: choppers, scrapers, utilized flakes, bifaces, and projectile points. In addition, stone core materials were collected from the high terrace cobbles, and first and second stage lithic reduction was made in the field (VAR50, 51). However, the finishing of stone-tool manufacture was not conducted here, but the tool blanks were returned to the bottomland base camps for finishing.

The SPSS nonparametric correlation program (NONPAR CORR) for rank-order data were run pairing site attributes and onsite artifact frequencies against game animal potential as listed on Table 6.2. The significant results ($p = < 0.05$) are reported as follows:

Site Size (VAR33) shows significant correlation with *antelope, deer, and jackrabbit* ratings. Both antelope and jackrabbits are negatively correlated, indicating that these animals were taken from small size sites; likely special-activity hunting camps situated away from the river on the upland plains where grassland forage is plentiful. In contrast, deer (VAR23) are positively correlated with large size base camps which are situated near the Arkansas River at low elevations. Since deer are riparian browsers on the central High Plains, they were hunted from the large base camps located near such river bottom habitat.

VAR34, Number of Artifact Types, shows the same correlation pattern as VAR33, Site Size. This is so because the base camps, from which deer were hunted, have a wide range of activities, whereas the antelope and jackrabbits were hunted from small, temporary upland camps expressing a limited number of activities; probably hunting and butchering only.

TABLE 6.2
LIST OF STATISTICS OUTPUT BY SPSS PROGRAM NONPAR CORR

Var. No.	With Var. No.	Correlation Coefficient	Significance (p = No.)	N	Variable Name
33	22	S = - 0.1852	0.034	99	Site Size
	23	S = 0.2290	0.012	99	
	24	S = - 0.2780	0.003	99	No. Artifact Types
34	22	K = - 0.1285	0.030	99	
	23	S = 0.1664	0.050	99	
	24	K = - 0.1356	0.024	99	
35	22	S = 0.2333	0.011	98	Artifact Density
	23	S = - 0.2955	0.002	98	
	24	S = 0.3173	0.001	98	
	25	K = - 0.1283	0.030	98	
36	21	S = - 0.3000	0.002	99	Site Density/1 km
	24	S = 0.3418	0.001	99	
	25	S = 0.2766	0.003	99	
	27	S = 0.4586	0.001	99	
37	21	S = - 0.3516	0.001	99	Site Density/3 km
	23	K = - 0.1607	0.010	99	
	24	S = 0.4772	0.001	99	
	25	K = 0.1138	0.048	99	
	27	S = 0.5070	0.001	99	
39	21	S = 0.1999	0.024	48	Hammer %
	27	S = - 0.1688	0.048	48	
40	21	K = - 0.1230	0.036	80	Scraper %
	26	K = - 0.1206	0.039	80	
	28	K = - 0.1206	0.039	80	
41	21	S = - 0.2331	0.011	47	Biface %
	22	S = - 0.2298	0.012	47	
	23	K = 0.1126	0.050	47	
	24	K = - 0.1308	0.028	47	
	25	K = 0.1241	0.035	47	
42	22	S = - 0.1877	0.032	10	Proj. Pt. %
	23	S = 0.2430	0.008	10	
	24	S = - 0.4117	0.001	10	
	26	S = 0.3312	0.001	10	
	28	S = 0.3312	0.001	10	

Table 6.2 - Continued

Var. No.	With Var. No.	Correlation Coefficient	Significance	N	Variable Name
44	21	S = - 0.1942	0.028	11	Graver %
	27	S = 0.2201	0.015	11	
45	22	K = 0.1327	0.026	86	Utilized Flake %
	23	S = - 0.3275	0.001	86	
	24	S = 0.3572	0.001	86	
46	22	S = - 0.1694	0.047	29	Flake Knife %
	23	S = 0.1834	0.035	29	
	24	K = - 0.1434	0.018	29	
	25	K = 0.1373	0.023	29	
47	21	S = 0.2532	0.006	27	Metate %
	23	S = 0.3343	0.001	27	
	24	S = - 0.3996	0.001	27	
	25	S = - 0.2349	0.010	27	
48	21	S = 0.3189	0.001	27	Mano %
	23	S = 0.2357	0.010	27	
	24	S = - 0.2795	0.003	27	
	27	S = - 0.2430	0.008	27	
49	23	K = - 0.1112	0.052	95	Core %
	24	K = 0.1173	0.043	95	
	26	K = - 0.1207	0.039	95	
	28	K = - 0.1207	0.039	95	
51	24	S = - 0.2891	0.002	78	Secondary Flake %
	26	K = 0.1352	0.024	78	
	27	S = - 0.1930	0.028	78	
	28	K = 0.1352	0.024	78	
52	24	S = - 0.3153	0.001	82	Tertiary Flake %
	25	K = - 0.1265	0.032	82	
	27	S = - 0.2774	0.003	82	
53	23	S = 0.2341	0.010	13	Biface Thinning Flake %
	24	S = - 0.2358	0.010	13	
55	26	S = 0.2103	0.019	21	Unclassified Flake %
	28	S = 0.2103	0.019	21	
56	21	S = - 0.2183	0.015	40	Miscellaneous Core Tools %

Table 6.2 - Continued

Var. No.	With Var. No.	Correlation Coefficient	Significance	N	Variable Name
	24	S = 0.2747	0.003	40	
	25	S = 0.2350	0.010	40	
	27	S = 0.3709	0.001	40	
58	21	K = 0.1236	0 035	22	Unclassified Ground Tools %
	24	S = - 0.1682	0.049	22	
	27	K = - 0.1293	0.029	22	

Legend:	VAR21	Bison Rating
	VAR22	Antelope Rating
	VAR23	Deer Rating
	VAR24	Jackrabbit Rating
	VAR25	Cottontail Rabbit Rating
	VAR26	Elk Rating
	VAR27	Upland Gamebird Rating
	VAR28	Waterfowl Rating
	S	Spearman Correlation Coefficient
	K	Kendall Correlation Coefficient

VAR35, Artifact Density, shows the reverse pattern when compared to VAR33 and 34. Here the large, low density base camps correlate very highly with deer and cottontail rabbit hunting, while the small upland hunting camps, of relatively high artifact density, correlate with antelope and jackrabbit.

Site density within 1- and 3-km circles, VAR36 and VAR37, are positively correlated with jackrabbit, cottontail, and upland game bird potentials and inversely related to bison rating (VAR22). These patterns are consistent with the Scattergram model in which the high density upland special-activity sites are hunting camps while the riverside base camps appear in low density. Thus, the upland camps were deployed for the hunting of jackrabbits, cotton-rail, and upland game birds while bison were sought from the base camps.

Hammers, found on base camps, are directly associated with bison and avoid (negative corre-lation) upland game birds. Scrapers, which appear on special-activity sites, are negatively correlated with both bison and elk which were hunted from base camps. Similarly bifaces, with a Scattergram association with special-activity sites, avoid bison, antelope, and jackrabbits while positively correlating with deer and cottontail rabbits. Projectile points, although low in number (N=10), are strongly associated with upland hunting camps. Therefore, it is surprising to find that they have a negative correlation with both antelope and jackrabbits. Perhaps the former were taken by drive and impound techniques while the rabbits could have been hunted with group surround and throwing sticks. Instead, projectile points are positively associated with large size game including deer, elk, and waterfowl.

Gravers, which could not be arranged on the Scattergram model of site types (Figure 6.1), are negatively correlated with bison and positively related to upland game bird ratings. This suggests that the engraving tools were used on upland hunting camps; perhaps in manufacturing traps and/or nets for catching the birds.

Utilized fla... tools are strongly correlated with special-activity camps through Scattergram correlation. Using the NONPAR CORR program, it was found that they associate with antelope and jackrabbit hunting; perhaps for butchering and the manufacture of the nonprojectile point tools employed in taking this game. In contrast, utilized flakes show a negative avoidance of deer hunted from low elevation base camps.

Milling tools such as metates, manos, and miscellaneous ground-stone artifacts, are signifi-cantly related to riverside base camps. Here they associated with bison and deer. An interpreta-tion of this relationship could be that the game animal meat was sun dried ("jerked") for preservation and then ground with the milling tools for food service at the time of consumption. Conversely, game, such as jackrabbits, cottontail, and upland game birds, are avoided by milling tools indicating that they were prepared in other ways for food consumption at the high elevation hunting camps.

Cores are found on upland special-activity sites where they are part of a lithic procurement and reduction activity. Here they avoid deer, elk, and waterfowl which are riparian resources of the floodplain. However, cores are positively associated with jackrabbits but not necessarily in a cause-and-effect manner; both variables simply show high values on the same special-activity sites.

A seeming discrepancy is the fact that secondary flakes, which are also found on the upland lithic procurement stations in association with cores, are negatively correlated with jack-rabbits and upland game birds but positively related to elk and waterfowl; an unexpected conclusion to judge from the empirical model

derived from the Scattergram program (Figure 6.1). Tertiary flakes are base camp associates where they avoid jackrabbits, cottontail, and upland game birds.

Biface thinning flakes, which according to the pattern of the empirically derived Scattergram model should be associated with tool finishing and maintenance (reshape and resharpen) at base camps, are positively associated with deer and negatively with jackrabbits.

Unclassified flakes were recorded on base camps where they are positively correlated with elk and waterfowl. And finally, the miscellaneous core tools appear on upland hunting camps from which jackrabbit, cottontail, and upland game birds were taken. In contrast, the core tools avoid base camps from which bison were hunted.

6.1.2 NTSYS ANALYSIS OF SITE TYPES

As explained in Section 4.3.3.3, NTSYS was used to cluster 99 sites into seven numbered site types, some of which are further divided into subtypes by visual inspection to form VAR32 (Figure 6.3). Clustering was based on 22 tool and lithic debitage variables. Figure 6.3 is a dendrogram (phenogram) which graphically illustrates the clustering of sites and the degree of average-link similarity. In turn, the site clusters were examined in order to determine which artifacts were significantly contributing to the site type differences (Figure 6.4). By this means, the functional significance of each descriptive type and subtype was determined (Figure 6.5). Further interpretation of the site type functions is examined in Section 6.2 where cross-tabulation of the site types with environmental variables reveals which specific habitats (VAR8 - SCS range sites) and/or game (VAR21-28) are associated.

Site Type 1: This site type is subdivided into five subtypes constituting clustering of 35 archeological sites (Figure 6.3). All favor two range site habitat: Numbers 6 and 64. Two subtypes, 1.2 and 1.4, significantly correlate with game ratings. Subtype 1.2 associates with both upland and riverside game, while Type 1.4 is an upland hunting camp. Functional task-activities interpreted from the tool assemblage indicates general and special processing, core reduction, and tool finishing and maintenance.

Site Type 2: Ten archeological sites cluster to form this hunting camp type (Figure 6.2). Nonparametric correlation of these sites with game animal ratings indicate hunting within Range Site 64 for both upland and riverside species. The tool assemblage reflects both general and specialized processing of materials as well as core reduction. (Figure 6.5).

Site Type 3: Both general and special processing of materials, core reduction, and tool finishing and maintenance are indicative of task-activities at this site type. Four sites cluster to form this undifferentiated site type. Neither the range site habitat nor game animal associations were detectable in the analysis.

Site Type 4: Five archeological sites clustered to form this undifferentiated site type. Although no range site habitat or game animals were associated, still some information was obtained as to the site function by translating the artifact assemblage into task-activities. From this operation, shown on Figure 6.5, it is thought that Site Type 4 was involved in special and general processing, core reduction, and tool finishing and maintenance.

Site Type 5: Three subtypes were clustered from twenty archeological sites constituting Type 5. Subtype 5.2 correlates with both upland and riverside game potentials, whereas the other two subtypes reflect special activities other than hunting. The range site association indicates

FIGURE 6.3
DENDROGRAM OF SITE CLUSTERS
JOHN MARTIN RESERVOIR PROJECT

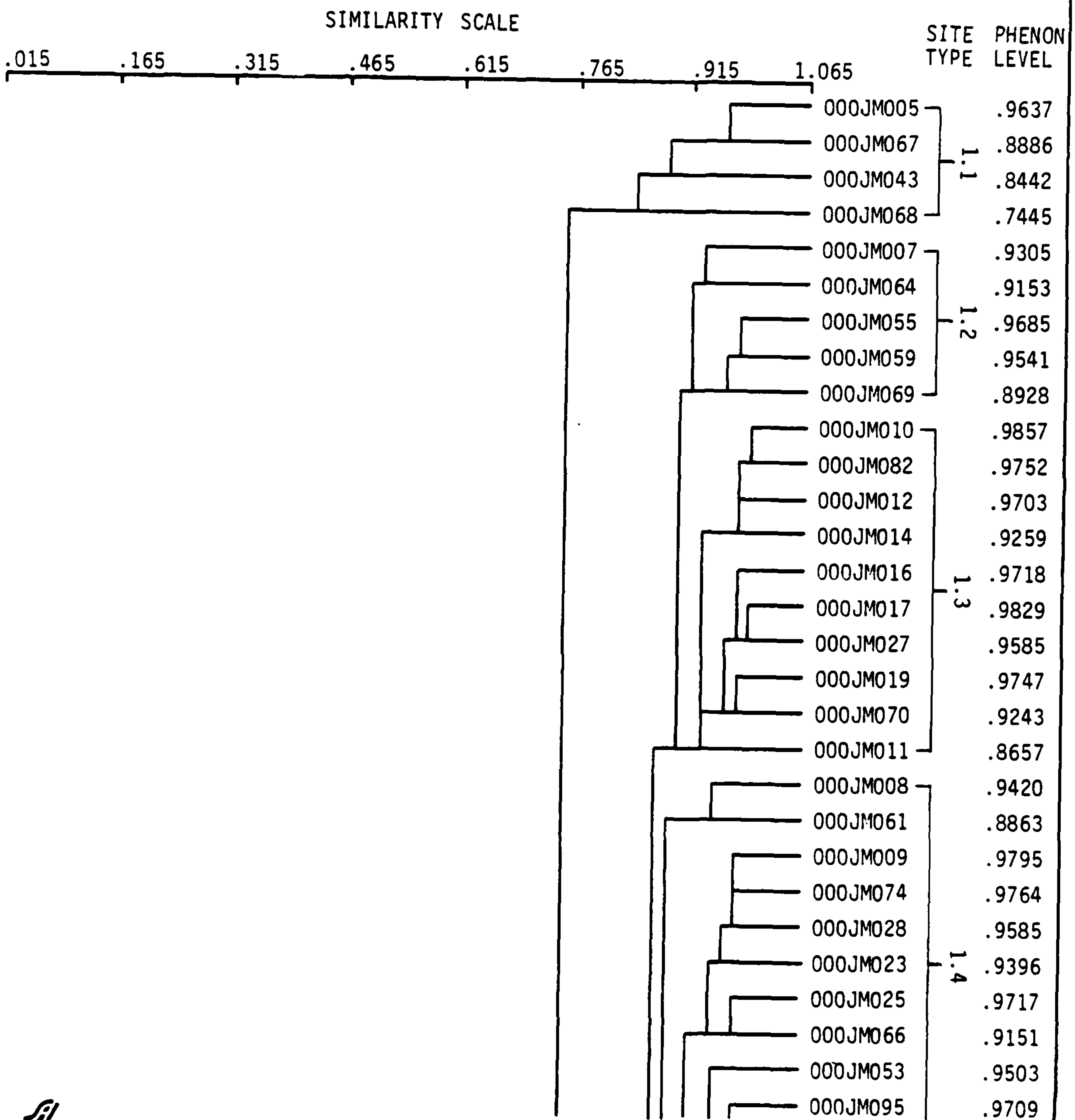


FIGURE 6.3 continued

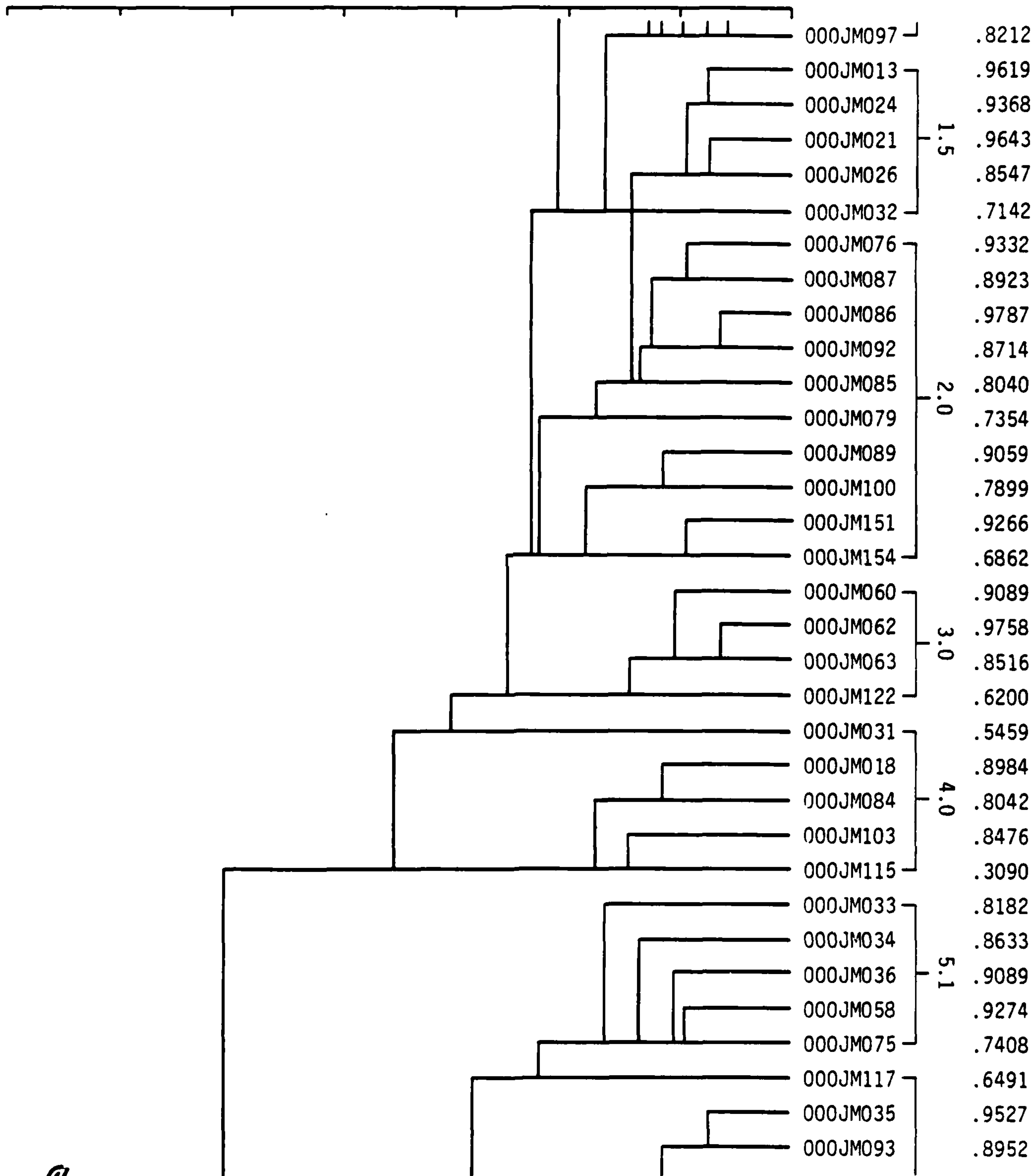


FIGURE 6.3 continued

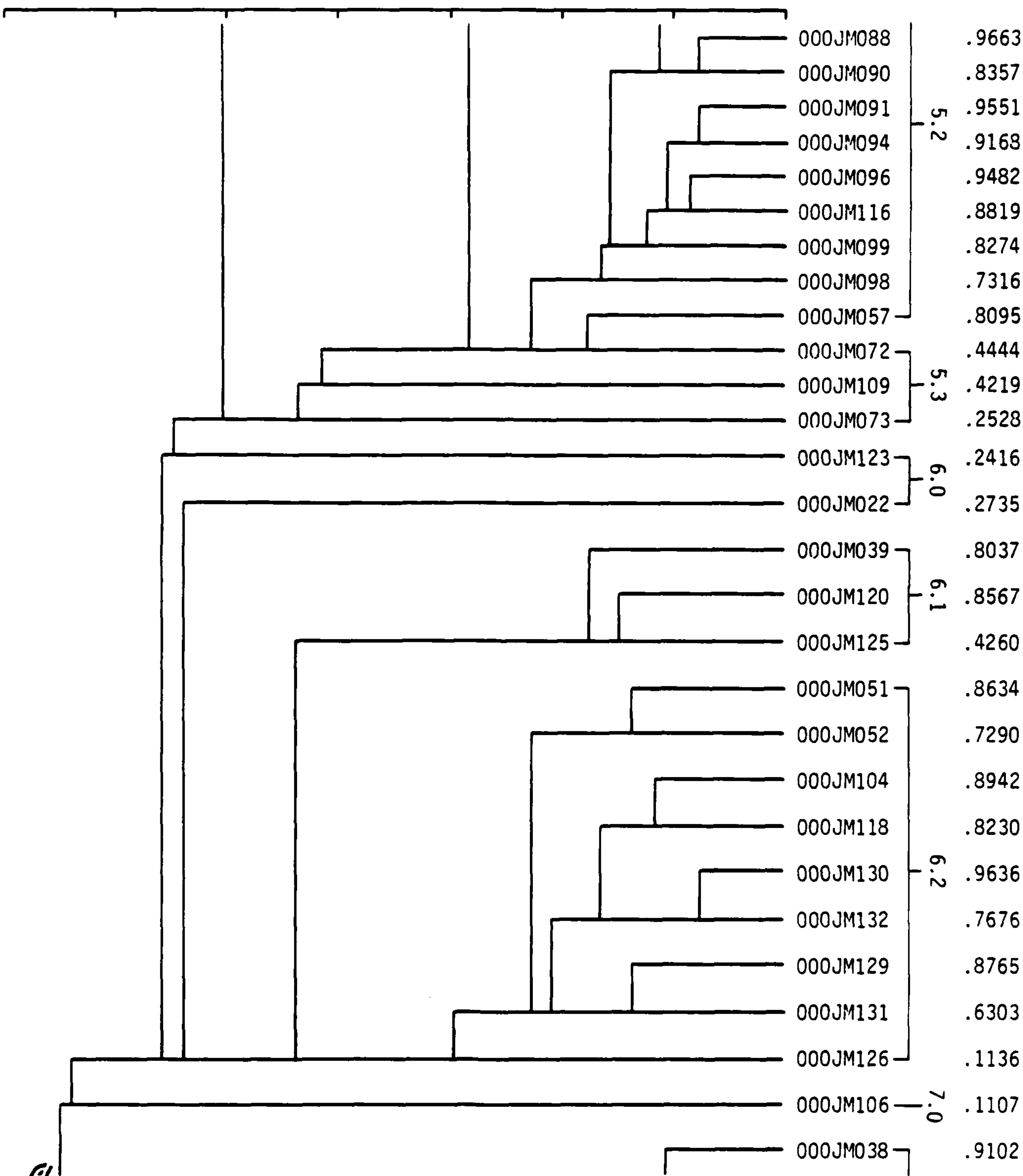


FIGURE 6.3 continued

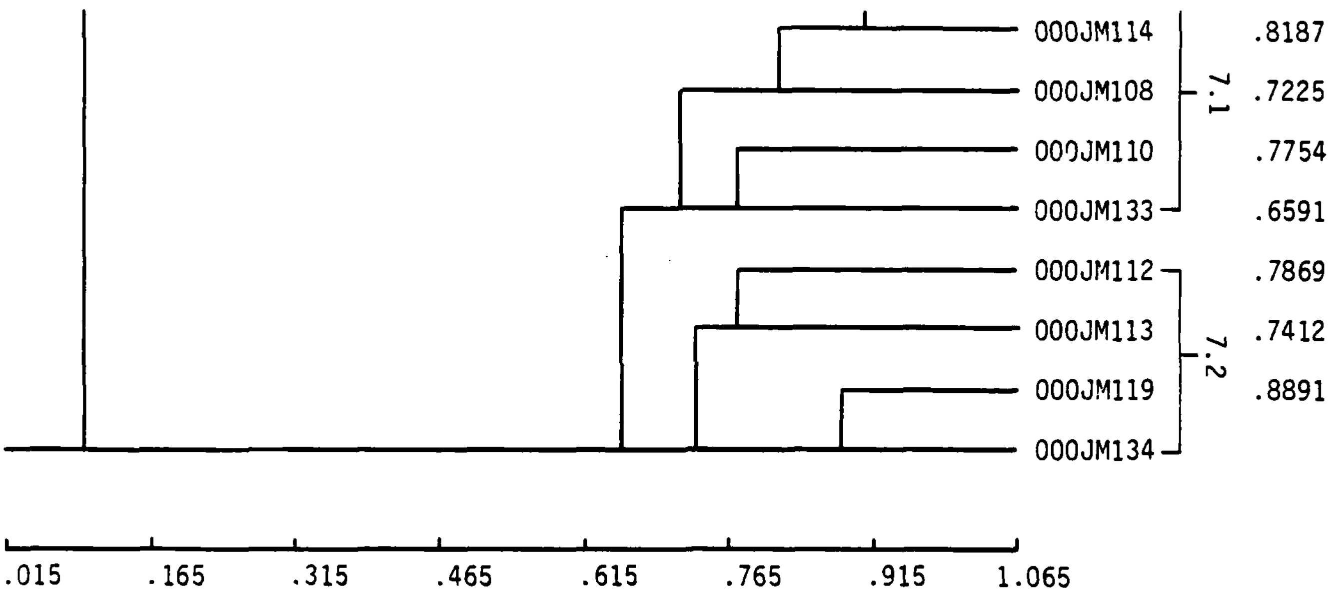


FIGURE 6.4
FUNCTIONAL SITE TYPOLOGY OF VARIABLE 32

Site Type	Sites	By Clusters	Phenon Level	Significant Artifact Types
1.1	JM 005		0.84	Utilized Flakes (4), 31-47%
	043			Cores (4), 3-15%
	067			Primary Flakes (4), 6-14%
	068	N = 4		Secondary Flakes (4), 9-23%
				Tertiary Flakes (4), 6-12%
1.2	JM 007		0.91	Utilized Flakes (5), 44-68%
	055			Cores (5), 3-14%
	059			Primary Flakes (5), 3-8%
	064			Secondary Flakes (5), 3-14%
	069	N = 5		
1.3	JM 010	JM017	0.89	Chopper (10), 1-17%
	011	019		Scrappers (9), 1-17%
	012	027		Bifaces (7) 1-6%
	014	070		Utilized Flakes (10), 39-52%
	016	082		Cores (10), 6-18%
		N = 10		Secondary Flakes (5), 2-8%
				Tertiary Flakes (6), 2-11%
				Miscellaneous Core Tools (10), 6-23%
1.4	JM 008	JM061	0.86	Choppers (8), 4-13%
	009	066		Scrappers (8), 2-14%
	023	074		Utilized Flakes (11), 29-51%
	025	095		Cores (11), 20-30%
	028	097		Primary Flakes (6), 4-15%
	053	N = 11		Secondary Flakes (6), 2-13%
				Tertiary Flakes (9), 1-6%
				Miscellaneous Core Tools (7), 2-15%
1.5	JM 013	JM026	0.71	Choppers (3), 4-11%
	021	032		Scrappers (4), 1-5%
	024	N = 5		Bifaces (3), 1-8%
				Utilized Flakes (5), 27-41%
				Flake Knives (4), 1-9%
				Cores (5), 13-26%
				Primary Flakes (3), 2-12%
				Secondary Flakes (3), 3-14%
				Tertiary Flakes (5), 2-8%
				Miscellaneous Core Tools (5), 15-26%
2.0	JM 076	JM092	0.71	Choppers (10), 3-11%
	079	100		Scrappers (10), 10-33%
	085	151		Hammers (9), 1-10%
	086	154		Bifaces (6), 1-9%
	087	N = 10		Utilized Flakes(10), 23-47%
	089			Cores (10), 6-30%
				Primary Flakes (10), 4-30%

Figure 6.4 - continued

Site Type	Sites	By Clusters	Phenon Level	Significant Artifact Types
3.0	JM 060		0.68	Choppers (2), 3-5%
	062			Bifaces (2), 2%
	063			Utilized Flakes (4), 21-35%
	122	N = 4		Cores (4), 25-46%
				Primary Flakes (3), 30-60%
				Secondary Flakes (4), 8-15%
				Tertiary Flakes (3), 13-22%
4.0	JM 018	JM013	0.54	Choppers (3), 3-7%
	031	115		Scrappers (5), 2-23%
	084	N = 5		Utilized Flakes (5), 16-27%
				Cores (5), 6-12%
				Primary Flakes (3), 7-13%
				Secondary Flakes (4), 13-35%
				Tertiary Flakes (4), 2-8%
5.1	JM 033	JM058	0.74	Scrappers (3), 4-10%
	034	075		Utilized Flakes (4), 7-14%
	036	N = 5		Cores (5), 6-27%
				Primary Flakes (5), 13-25%
				Secondary Flakes (5), 25-43%
				Tertiary Flakes (5), 7-18%
5.2	JM 035	JM096	0.65	Choppers (6), 1-9%
	057	098		Scrappers (12), 1-15%
	088	099		Bifaces (9), 1-15%
	090	116		Utilized Flakes (6), 1-8%
	091	117		Cores (12), 23-45%
	093	N = 12		Primary Flakes (12), 7-44%
	094			Secondary Flakes (12), 4-26%
				Tertiary Flakes (10), 2-20%
5.3	JM 072	N = 3	0.42	Hammers (3), 3-5%
	073			Scrappers (3), 1-5%
	109			Utilized Flakes (3), 2-6%
				Cores (3), 11-38%
				Primary Flakes (3), 6-23%
				Secondary Flakes (3), 5-18%
				Tertiary Flakes (3), 2-3%
6.0	JM 122	N = 2	0.24	Utilized Flakes (2), 13-14%
	123			Cores (2), 10-11%
				Tertiary Flakes (3), 3-14%
6.1	JM 039	N = 3	0.80	Scrappers (3), 20-40%
	120			Utilized Flakes (3), 5-17%
	125			Flake Knives (2), 5-6%
				Secondary Flakes (2), 6-10%
				Tertiary Flakes (3), 8-18%

Figure 6.4 - continued

Site Type	Sites	By Clusters	Phenon Level	Significant Artifact Types
6.2	JM 051	JM120	0.63	Hammer (8), 1-6%
	052	130		Scrappers (9), 1-12%
	104	131		Utilized Flakes (8), 1-6%
	118	132		Flake Knives (5), 1-4%
	126	N = 9		Metates (6), 6-26%
				Manos (6), 1-8%
				Cores (8), 1-24%
				Primary Flakes (8), 1-10%
				Secondary Flakes (9), 4-19%
				Tertiary Flakes (9), 22-54%
7.0	JM 106	N = 1	0.11	Hammer (1), 6%
				Scrapper (1), 6%
				Cores (1), 13%
				Rejuvenation Flakes (1), 13%
7.1	JM 038	JM114	0.72	Choppers (4), 1-4%
	108	133		Hammers (4), 1-7%
	110	N = 5		Scrappers (3), 1-11%
				Biface (4), 1-2%
				Utilized Flakes (5), 1-6%
				Flake Knives (3), 1%
				Metates (4), 24-26%
				Manos (4), 4-9%
				Cores (5), 5-21%
				Primary Flakes (5), 2-11%
				Secndary Flakes (5), 6-20%
				Tertiary Flakes (5), 4-17%
				Biface Thinning Flakes (3), 1-8%
7.2	JM 112	JM134	0.66	Hammers (3), 3-12%
	113	N = 4		Metates (4), 22-81%
	119			Manos (4), 6-21%
				Cores (4), 2-5%
				Secondary Flakes (3), 6-13%
				Tertiary Flakes (3), 3-11%
				Unclassified Ground Stone (3), 3-18%

(no.) = number of sites with artifact loadings; no. - no.% = frequency range of artifact loadings

FIGURE 6.5
INTERPRETATION OF NTSYS SITE TYPOLOGY

Site Type	Range Site	Game Animals	Tool Kit	Functional Activity Tasks
Special Activity Sites: quarrying and hunting				
1.1	6,64	----	Utilized flakes Cores and Primary flakes Tertiary flakes	general processing core reduction tool finishing and maintenance
1.2	6,64	both upland and riverside	Utilized flakes Cores and Primary flakes	general processing core reduction
1.3	6,64	upland	Heavy duty cutting tools Utilized flakes Cores and Primary and Tertiary flakes	special processing general processing core reduction tool finishing and maintenance
1.4	6,64	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes	special processing general processing core reduction
1.5	6,64	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes Tertiary flakes	special processing general processing core reduction tool finishing and maintenance
Hunting Camps:				
2.0	64	both upland and riverside	Heavy duty cutting tools Utilized flakes Cores and Primary flakes	special processing general processing core reduction
Undifferentiated Sites:				
3.0	----	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes Tertiary flakes	special processing general processing core reduction tool finishing and maintenance
Undifferentiated Sites:				
4.0	----	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes Tertiary flakes	special processing general processing core reduction tool finishing and maintenance

Figure 6.5 - continued

Site Type	Range Site	Game Animals	Tool Kit	Functional Activity Tasks
Special Activity Sites: quarrying and hunting camps				
5.1	53,64	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes Tertiary flakes	special processing general processing core reduction tool finishing and maintenance
5.2	53,64	both upland and riverside	Heavy duty cutting tools Utilized flakes Tertiary flakes	special processing general processing tool finishing and maintenance
5.3	53,64	----	Heavy duty cutting tools Utilized flakes Cores and Primary flakes Tertiary flakes Hammers	special processing general processing core reduction tool finishing and maintenance tool manufacture
6.0	6,53	----	Utilized flakes Cores Tertiary flakes	general processing core reduction tool finishing and maintenance
6.1	6,53	----	Heavy duty cutting tools Utilized flakes Tertiary flakes	special processing general processing tool finishing and maintenance
6.2	6,53	riverside bison	Heavy duty cutting tools Utilized flakes Tertiary flakes Hammer Milling tools	special processing general processing tool finishing and maintenance tool manufacture seed milling
Base Camps: quarrying, tool manufacture and maintenance, milling of seeds				
7.0	1-9	----	Heavy duty cutting tools Hammers Cores Rejuvenation flakes	special processing tool manufacture core reduction tool maintenance
7.1	1-9	----	Heavy duty cutting tools Utilized flakes Hammers Milling tools Core and Primary flakes Tertiary flakes and Biface Thinning flakes	special processing general processing tool manufacture seed milling core reduction tool finishing and maintenance

Figure 6.5 - continued

Site Type	Range Site	Game Animals	Tool Kits	Functional Activity Tasks
7.2	1-9	----	Hammers Milling tools Cores Tertiary flakes	tool manufacture seed milling core reduction tool finishing and maintenance

resource exploitation in habitats, Numbers 53 and 64. The tool assemblage is interpreted as general and special processing of materials, and tool finishing and maintenance.

Site Type 6: Site Type 6, including three subtypes numbered 6.0, 6.1, and 6.2, constitutes a set of 14 archeological sites (Figure 6.3). The sites are associated with Range Sites 6 and 53. One subtype, Number 6.2, is correlated with the hunting of riverside bison. Interpretation of the tool assemblage indicates general and special processing of materials, tool manufacture, seed milling, tool finishing and maintenance as functional activities conducted at this site type (Figure 6.5). Particularly, seed milling and bison hunting are accepted as evidence that Type 6 sites are riverside base camps.

Site Type 7: Three subtypes, 7.0, 7.1, and 7.2, reflect subclusters of the 10 archeological sites making up this site type. No game animal potential is determined and the range site habitat was not detectable. However, the wide range of tool types and activities strongly indicates that Type 7 sites are riverside base camps. The indicated tasks are: special and general processing of materials, core reduction, tool manufacture, tool finishing and maintenance, and seed milling. Particularly, the high frequency of milling tools strongly suggests base camps situated on the stabilized dunes along the south side of the Arkansas River.

6.2 FACTORS AFFECTING SELECTION OF SITE LOCATION

Prehistoric decisions to locate sites on the landscape were determined by a series of environmental factors. Thus, the presence or absence of water, vegetation type, game animals, and lithic resources are all factors to which prehistoric peoples related in the course of a seasonal round of subsistence and settlement activities. In order to empirically determine which factors were most influential in locational decision making, associational and multivariate correlation statistics were run in order to relate environmental variables with functional site type. The assumption employed is that environmental factors are causal and explain patterns of site location. To solve the cause-and-effect puzzle, two statistics were employed: Chi-Square and Multiple Regression.

6.2.1 CROSSTABS

Program CROSSTABS was run on discrete variables Number 32 (site type) by environmental variables VAR8 and VAR21 through 28. CROSSTABS prints out a contingency table and computes the raw Chi-Square degrees of freedom, and significance for pairs of nominal variables (Table 6.3). The analysis for the pair VAR8 by VAR32 was handled in two steps. The first trial established six site types against eight range site types. The resulting contingency table contained 24 empty cells which violates a rule of Siegel (1956:110) that no cell will be empty of expected frequency; *a condition which* artificially inflates the raw Chi-Square value. In order to eliminate so many empty cells, the low frequency range sites were dropped out thereby collapsing the contingency table to a 4 x 6 matrix reproduced here as Table 6.3. Note that the SPSS printout does not show the expected frequency. To find the expected frequency of a cell, multiply the column total by the row total and divide by the grand total. For instance, Range Site 19 and Site Type 2, an empty cell, yields an expected frequency of 0.81 by multiplying 7 times 10 and dividing by 87 (Siegel 1956:105). This two-step operation reduced the count of archeological sites from 92 to a count of 87 available for analysis. The large Chi-Square is highly significant at much less than an alpha of 0.05.

The results show that the distribution of archeological site types is highly nonrandom. Range Site 6 is favored by Site Type 1 and to a

TABLE 6.3
CROSS TABULATION OF RANGE SITE TYPE BY ARCHEOLOGICAL SITE TYPE

VAR8 RANGE SITE TYPE BY VAR32 SITE TYPE

* *

VAR8	VAR32: COUNT / ROW PCT / COL PCT / TOT PCT	10.	20.	40.	50.	60.	70.	ROW TOTAL
6.	COUNT	11	3	2	6	7	1	30
	ROW PCT	36.7	10.0	6.7	20.0	23.3	3.3	34.5
	COL PCT	37.9	30.0	40.0	30.0	50.0	11.1	
	TOT PCT	12.6	3.4	2.3	6.9	8.0	1.1	
19.	COUNT	0	0	1	1	0	5	7
	ROW PCT	0	0	14.3	14.3	0	71.4	8.0
	COL PCT	0	0	20.0	5.0	0	55.6	
	TOT PCT	0	0	1.1	1.1	0	5.7	
53.	COUNT	1	0	1	6	6	3	17
	ROW PCT	5.9	0	5.9	35.3	35.3	17.6	19.5
	COL PCT	3.4	0	20.0	30.0	42.9	33.3	
	TOT PCT	1.1	0	1.1	6.9	6.9	3.4	
64.	COUNT	17	7	1	7	1	0	33
	ROW PCT	51.5	21.2	3.0	21.2	3.0	0	37.9
	COL PCT	58.6	70.0	20.0	35.0	7.1	0	
	TOT PCT	19.5	8.0	1.1	8.0	1.1	0	
COLUMN TOTAL		29	10	5	20	14	9	87
		33.3	11.5	5.7	23.0	16.1	10.3	100.0

RAW CHI SQUARE = 58.40783 WITH 15 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

lesser degree Site Type 6. Range Site 19 is overrepresented by Site Types 1 and 6. Range Site 53 contains Site Types 5 and 6 in more than expected numbers while being underrepresented by Site Type 2. And finally, Range Site 64 has the largest proportion of Site Type 1 with significant numbers of Site Type 2 and 5 (Table 6.3, Column 2).

Next site type, VAR32, was cross-tabulated with ordinal variables for game animal ratings (VAR21-28). Significant associations are listed by archeological subtype when their values were 10.0% or more of the total sample of sites shown at the bottom of Table 6.4 (N = No.). These game animal ratings, taken from the significant SCS range sites, indicate that archeological Site Types 1.3, 1.4, 2.0, 5.2 and 6.2 are upland hunting camps and/or base camps from which riverside game was hunted. It is also significant that archeological Site Types 1.1, 1.2, 1.5, 3.0, 4.0, 5.1, 5.3, 6.1, and the series of Type 7's show no animal loadings, and therefore, are not hunting camps.

Site Type 1.4, showing a significant association of antelope, jackrabbit, and cottontail, can be identified as an upland hunting camp favoring Range Sites 6 and 64. Archeological Site Type 6.2 has a high loading of bison, and therefore, is a riverside base camp. However, the remaining three hunting site types show a mixture of game loadings. Site Types 1.3, 2.0, and 5.2 have upland game (antelope, jackrabbit, and game birds) combined with riparian animals such as deer, bison, and cottontail. Likely these are intermediate elevation camps from which both habitats were hunted.

6.2.2 REGRESSION

The Multiple Regression analysis was designed so that 12 independent environmental variables (VAR9-20) could predict dependent site attributes, VAR7, 31, and 33 through 37 (Figure 4.6). Of this entire set, only Site Density Variables 36 and 37 generated significant results (Table 6.5).

The 12 independent variable predictors yielded a Multiple R coefficient of 0.96066 for the dependent variable: Site Density in 1-Km Circle (VAR36). These x-axis predictors worked in concert to explain 0.92287 (92%) of the variance in VAR36 to form a very efficient and accurate predictive model. The overall F-statistic of 7.97684 is highly significant at a probability of 0.003; far less than the required alpha value employed throughout this study. Of the 12 independent environmental variables, eight have negative Simple R correlation coefficients indicating inverse relationships between these variables and the density of sites in a 1-km circle. Thus as Slope at Site (VAR9), Height above Intermittent Drainage (VAR15), Percentage of Dominant Range Site (VAR18), Aspect (VAR11), Standing Crop Yield (VAR20), Distance to Arkansas (VAR15), Distance to Nearest Intermittent Drainage (VAR13), and Height Above Arkansas (VAR16) decreases, the density of surrounding sites is predicted to increase. Conversely, as Slope at Site (VAR10), Distance to Edge of Range Site (VAR17), Site Elevation (VAR12), and Number of Range Sites (VAR19) increases, then so will VAR36, Site Density in 1-km Circle.

All but three of these 12 variables fit the Scattergram model for the special-activity sites (Figure 6.1). These exceptions are VAR15, 16, and 17 which apply more appropriately to the base camps.

Thus nine of the environmental variables are in accord in predicting the small, temporary hunting and lithic reduction camps which occur on the dry upland prairie where they are located near intermittent drainages and on the edge (ecotone) of SCS range sites with a low standing crop yield.

TABLE 6.4
LIST OF SITE TYPES AND HIGHLY ASSOCIATED ENVIRONMENTAL VARIABLES

Archeological Site Subtype	Significant Range Site	Game Animal Potential
1.1	6,64	
1.2	6,64	
1.3	6,64	Antelope (10.1%); Deer (12.1%); Jackrabbit (10.1%); Cottontail (10.1%); Upland Game Bird (12.1%);
1.4	6,64	Antelope (10.1%); Jackrabbit (10.1%); Cottontail (10.1%);
1.5	6,64	Antelope (10.1%); Deer (10.6%); Jackrabbit (10.1%); Cottontail (10.1%); 3.0
4.0		
5.1	53,64	
5.2	53,64	Bison (11.4%); Antelope (12.1%); Deer (10.6%); Jackrabbit (12.1%); Cottontail (12.1%); Upland Game Bird (10.6%);
5.3	53,64	
6.1	6,53	
6.2	6,53	Bison (11.4%);
7.0	19	
7.1	19	
7.2	19	

Bison: N = 44
Jackrabbit, Cottontail, Antelope: N = 99
Upland Game Bird, Deer: N = 66

TABLE 6.5
MULTIPLE REGRESSION PREDICTIONS ON VAR36 AND 37 USING 12 INDEPENDENT ENVIRONMENTAL VARIABLES (VAR9 - 20)

VAR36 Site Density in One-Kilometer Circle

SUMMARY TABLE

Variable Entered	Variable Removed	F to Enter or Remove	Significance	Multiple R	R Square	R Square Change	Simple R	Overall F	Significance
VAR9		10:02637	.013	.34397	.11832	.11832	-.34397	7.97684	.003
VAR14		1.03230	.339	.35051	.12286	.00454	-.06789		
VAR18		8.19811	.021	.53980	.29138	.16852	-.35645		
VAR11		6.15980	.038	.61220	.37479	.08341	-.21645		
VAR20		7.75998	.024	.67312	.45309	.07830	-.17377		
VAR15		6.16119	.038	.70013	.49018	.03709	-.43682		
VAR10		6.78848	.031	.76046	.57830	.08812	.13387		
VAR17		8.61929	.019	.88003	.77446	.19615	.06995		
VAR12		.33661	.578	.89508	.80117	.02671	.35520		
VAR13		3.41569	.102	.91448	.83628	.03511	-.68365		
VAR19		.74371	.414	.92590	.85730	.02102	.23834		
VAR16		6.80132	.031	.96066	.92287	.06557	-.26977		

VAR37 Site Density in Three-Kilometer Circle

SUMMARY TABLE

Variable Entered	Variable Removed	F to Enter or Remove	Significance	Multiple R	R Square	R Square Change	Simple R	Overall F	Significance
VAR9		4.29600	.072	.01412	.00020	.00020	.01412	4.36823	.022
VAR14		22.85001	.001	.31365	.09838	.09818	-.31331		
VAR18		1.08278	.328	.42974	.18467	.08630	-.30930		
VAR11		.48704	.505	.52884	.27968	.09500	.30317		
VAR20		9.30630	.016	.61347	.37635	.09667	-.17725		
VAR15		8.54783	.019	.69691	.48568	.10934	-.32457		
VAR10		6.93366	.030	.73372	.53834	.05266	.12586		

Figure 6.5 - continued

Variable Entered	Variable Removed	F to Enter or Remove	Significance	Multiple R	R Square	R Square Change	Simple R	Overall F	Significance
VAR17		.00535	.943	.75494	.56994	.03160	-.06114		
VAR12		4.74611	.061	.80480	.64771	.07777	.24934		
VAR13		.00326	.956	.80589	.64946	.00175	-.38046		
VAR19		8.70914	.018	.91366	.83477	.18531	.01181		
VAR16		1.98288	.197	.93145	.86759	.03282	-.28373		

A federal manager could utilize the VAR36 predictive model to spot areas of potential high site density on topographic and SCS range site maps followed by ground inspection. The conjunction of ephemeral drainages and SCS range site boundaries should yield large numbers of the upland special-activity fly camps. Thus the Regression Model does exactly what it was designed to do; that is predict the greatest number of archeological sites subject to potential natural and cultural impacts to be discussed in Section 11.0. However, the ironic aspect of this study is that the large riverside base camps, of relative low census, are not accounted for by the Regression Model. An attempt was made to remedy this situation by using the same environmental predictors and VAR7, Number of Artifacts, since the largest concentrations of artifacts occur near the modern floodplain of the Arkansas just above the modern reservoir lake level. However, the Multiple R of such a Regression was only 0.30093 explaining just 9% of the variance. Similarly, the significance of the Overall F-statistic (0.57257) was too large (∂= 0.857) to meet the probability requirements of this study.

A second predictive Regression Model is shown at the bottom of Table 6.5. Here the same 12 environmental predictors were regressed against VAR37, Site Density in a 3-km Circle. The predictive efficiency is very nearly as good as expressed by the Multiple R coefficient of 0.93145; a statistic which accounts for over 86% (0.86759) of the Y-value variance. Similarly the F-statistic of 4.36823 is significantly well below the 0.05 cut off probability (∂ = 0.022). In this second Regression Model, only seven Simple R coefficients have a negative sign (VAR14, 18, 20, 15, 17, 13, and 16). In this model, two former negative coefficients have turned positive and one former positive value has turned negative. By casting a larger catchment net, more slope values have been added to the site density prediction as have aspect headings of higher values. Distance to Edge of Range Site is now negative as it should be according to the Scattergram model for special-activity sites (Figure 6.1).

A second problem to be solved with Multiple Regression analysis is the retrodictive sampling experiment (Section 4.0). The research question asked here is how large a sample of sites is actually necessary in order to make accurate site density predictions. Table 6.6 displays the results of the VAR36 and 37 Regression programs run on randomly drawn samples taken from the computer file of 99 cases. The left hand column lists the sampling levels with the program run for 0.05, 0.10, 0.15, 0.25, 0.30, 0.35, 0.40, 0.45, 0.50, and 1.00 fractions. Column 3 provides the actual number of cases (sites) drawn by the SPSS random sample generator. Note that some discrepancies exist between the actual numbers of sites employed in each analysis and the expected numbers shown in parentheses. These discrepancies, ranging from 2 to 14 sites under expected and one value over expected is a result of the approximate nature of the computer sampling process. Although some impact is to be seen, still the overall effect on the trends of increasing reliability is negligible. Columns 4 through 7 show the Multiple Regression results for each predicted variable (VAR36 and 37), as well as for each sampling level. Column 4 shows that not until the 25% sample are all 12 of the environmental predictors admitted into the Regression equation. Similarly the Multiple R, R-squared, and significance of the F-statistics are all 1.0 or invalid until the 15% sampling level is encountered. The Regression statistics are significant at or near the 0.05 level of probability from 30% and the percent of variance explained is very high for both equations.

In addition, two trials were run on the 50% sample coverage and this experiment reveals a second problem affecting sampling results - that of data quality. Not all sample grabs

TABLE 6.6
DATA FOR TESTING THE HYPOTHESIS 6 RETRODICTIVE SAMPLING EXPERIMENT, MULTIPLE REGRESSION OF VAR36, & 37 WITH 12 INDEPENDENT ENVIRONMENTAL VARIABLES

Dependent VAR No.	Sample Level	No. Cases (Sites)	Number Variables Not In Equation	Multiple R	R^2	F-Significance
36	0.05	2 (5)	11	1.0	1.0	1.0
37	0.05	2 (5)	11	1.0	1.0	1.0
36	0.10	8 (10)	05	1.0	1.0	1.0
37	0.10	8 (10)	05	1.0	1.0	1.0
36	0.15	14 (15)	02	0.99863	0.99727	0.141
37	0.15	(15)	02	0.92070	0.84770	0.832
36	0.25	23 (25)	00	0.77276	0.59715	0.374
37	0.25	23 (25)	00	0.93041	0.86566	0.006
36	0.30	28 (30)	00	0.86414	0.74674	0.010
37	0.30	28 (30)	00	0.88758	0.78781	0.003
36	0.35	36 (35)	00	0.84568	0.71517	0.001
37	0.35	36 (35)	00	0.82011	0.67258	0.002
36	0.40	37 (40)	00	0.74834	0.56002	0.025
37	0.40	37 (40)	00	0.77993	0.60827	0.009
36	0.45	40 (45)	00	0.67412	0.45444	0.086
37	0.45	40 (45)	00	0.69858	0.48801	0.049
36	0.50	36 (50)	00	0.70947	0.50335	0.083*
37	0.50	36 (50)	00	0.73479	0.53990	0.046*
36	0.50	46 (50)	00	0.60959	0.37160	0.132*
37	0.50	46 (50)	00	0.76394	0.58360	0.001*
36	1.00	99 (99)	00	0.96066	0.92287	0.003
37	1.00	99 (99)	00	0.93145	0.86759	0.022

* = Duplicate 50% Trials; VAR36 = Site Density in One-Kilometer Circle; VAR37 = Site Density in Three-Kilometer Circle; (No.) = expected sample value based on an N = 99

are of equal reliability as shown by the alpha values for the two VAR36 regression equations. That for 50% coverage with an actual unbiased grab of 36 sites has a larger Multiple R coefficient which is more significant than the second 50% sample trial with more cases (46 sites).

In conclusion, a sample of 30% of the population of sites is a minimum size for significant preditive results using these statistical procedures. And, in fact, a further increase in sample size does not greatly improve the Multiple R results until one reaches a complete census with sample level of 1.00.

6.3. INTRASITE TASK/ACTIVITY AREAS

Within-site analysis was performed by means of two computerized statistics: Nearest Neighbor and NTSYS (Section 4.3.1.3). The Nearest Neighbor analysis was accomplished on 97 prehistoric sites to determine if site artifact distributions deviated from *random patterns.* Alpha was set *a priori* at 0.05. Two sites had to be deleted due to mapping problems which compromised program assumptions: JM104 (5BN014) and JM108 (5BN231). Of these 97 sites, 24 (25%) had $N \leqslant 30$ and were analyzed using the Chi-Square distribution subprogram. The remaining 73 sites (75%) utilized the normal distribution subprogram. Table 6.7 delineates the Chi-Square and normal distribution sites.

The results of the analysis are presented in Table 6.7. Ninety-two sites were statistically significant at $\partial \leqslant 0.05$ at the first Nearest Neighbor level (r_1) in deviation from a random distribution. At level r_1, 86 sites (89%) showed clustered distributions ($R < 1.0$ and negative C scores), with 6 sites (6%) showing a tendency towards perfect ordering ($R > 1.0$ and positive C scores). Five sites (5%) were not significant at $r_1\ \partial > 0.05$. Of the 86 clustered sites, 58 (67%) were significant at $\partial = 0.01$, and 28 (33%) were significant at $\partial = 0.05$. Table 6.8 gives the raw counts and percentage frequencies of significant (clustered and perfect ordered) and nonsignificant (random) sites, together with the level of significance breakdowns ($\partial = 0.01$ and $\partial = 0.05$).

The second NN level (r_2) shows a total of 87 (94%) significant sites ($\partial \leqslant 0.05$), with 81 (88%) sites significant for clustering, and 6 (66%) sites tending to perfect order. Again, at r_2, five sites were not significant. Level r_3 has a total of 83 (95%) significant sites with 77 (88%) clustered, and again 6 (7%) ordered sites, with 4 (5%) sites random at r_3. Level r_4 has 68 (82%) clustered sites, 6 (7%) ordered, and 9 (11%) random sites. Level r_5 has 52 (70%) clustered, 6 (8%) and 16 (22%) random sites.

The distributions of clustered, ordered, and random sites at levels r_1 to r_5 were tested for significance using two statistics: the nonparametric Chi-Square one-sample and the parametric Binomial tests. The formulae for these tests are *presented below.*

One-Sample Chi-Square (Siegel 1956, 42-44).

Degrees of freedom: $df = k-1$

Where: k = number of columns (categories), E_i is the theoretical expected frequency under H_0, and O_i is the observed frequency.

Binomial (corrected for continuity):

Where: x is the smaller of the two frequencies, N is total number of observations, $P = Q = ½$. The correction for continuity is: $x < NP$: $x + 0.5$; $x > NP$: $x - 0.5$

TABLE 6.7
RESULTS OF NEAREST NEIGHBOR INTRASITE ANALYSIS

JM Site #	N	Density	Area (m^2)	R_n 1	R_n 2	R_n 3	R_n 4	R_n 5	C_n 1	C_n 2	C_n 3	C_n 4	C_n 5	r_n Level of Significance r_1	r_2	r_3	r_4	r_5	
005	52	6.081871×10^{-3}	8550	.735	.768	.915	1.04	1.09	-3.65	-4.61	-2.08	1.125	1.31	0.01	0.01	0.05	--	--	o
007	29	4.461538×10^{-3}	6500	-	-	-	-	-	-	-	-	-	-	0.05	0.05	0.05	0.05	0.05	x^2
008	59	1.348571×10^{-3}	43750	.507	.545	.585	.614	.662	-7.24	-9.63	10.84	11.69	-5.4	0.01	0.01	0.01	0.01	0.01	o
009	45	4.891304×10^{-3}	9200	.649	.820	.791	.853	.878	-4.51	-3.33	-4.76	-3.89	-1.72	0.01	0.01	0.01	0.01	0.05	o
010	63	6.631579×10^{-3}	9500	.768	.870	.857	.891	1.003	3.52	-2.85	-3.86	-3.41	.056	0.01	0.01	0.01	0.01	--	o
011	36	6.40×10^{-3}	5625	.933	.908	.914	.913	.967	-.765	-1.53	-1.75	-2.06	-.425	--	--	0.05	0.05	--	o
012	89	8.309991×10^{-3}	10710	.580	.630	.679	.796	.893	-7.57	-9.62	-10.29	-7.59	-2.08	0.01	0.01	0.01	0101	0.05	o
013	64	9.275362×10^{-3}	6900	.707	.767	.774	.768	.803	-4.49	-5.13	-6.16	-7.33	-3.28	0.01	0.01	0.01	0.01	0.01	o
014	18	9.350649×10^{-3}	1925	--	--	--	--	--	--	--	--	--	--	0.05	0.05	0.05	--	--	x^2
016	93	7.75×10^{-3}	12000	1.097	1.247	1.297	1.378	1.491	1.794	6.557	9.729	14.386	9.741	0.05	0.01	0.01	0.01	0.01	o
017	144	1.920×10^{-2}	7500	.878	.881	.914	.907	.962	-2.81	-3.92	-3.52	-4.38	-.939	0.01	0.01	0.01	0.01	--	o
018	15	3.750×10^{-3}	4000	--	--	--	--	--	--	--	--	--	--	0.05	0.05	0.05	--	0.05	x^2
019	75	8.476492×10^{-3}	8848	.665	.672	.702	.712	.792	-5.55	-7.82	-8.78	-9.84	-3.74	0.01	0.01	0.01	0.01	0.01	o
021	23	5.989583×10^{-3}	3840	--										0.05	0.05	--	--	0.05	x^2
022	28	1.120×10^{-1}	250	--										0.05	0.05	0.05	0.05	0.05	x^2
023	27	6.00×10^{-2}	450	--										0.05	0.05	--	0.05	0.05	x^2
024	32	2.3809524×10^{-2}	1344	.847	1.031	.971	.959	.971	-1.66	.486	-.560	-.911	-.349	0.05	--	--	--	--	o
025	23	2.0535714×10^{-2}	1120	--										0.05	0.05	0.05	0.05	--	x^2
026	70	3.2407407×10^{-2}	2160	.755	.857	.890	.929	.987	-3.93	-3.30	-3.13	-2.33	-.23	0.01	0.01	0.01	0.01	--	o
027	53	7.0666667×10^{-2}	750	1.42	1.42	1.39	1.40	1.48	5.79	8.41	9.62	11.58	7.36	0.01	0.01	0.01	0.01	0.01	o

Table 6.7 · continued

JM Site #	N	Density	Area (m^2)	R_n 1	R_n 2	R_n 3	R_n 4	R_n 5	C_n 1	C_n 2	C_n 3	C_n 4	C_n 5	r_n Level of Significance r_1	r_2	r_3	r_4	r_5	
028	54	2.160×10^{-2}	2500	1.46	1.35	1.37	1.37	1.47	6.39	6.998	9.25	10.68	7.17	0.01	0.01	0.01	0.01	0.01	o
030	12	7.50×10^{-3}	1600											0.05	0.05	0.05	0.05	0.05	x^2
031	17	1.1333333×10^{-2}	1500											0.05	0.05	0.05	0.05	0.05	x^2
032	26	4.333333×10^{-3}	6000											0.05	0.05	0.05	0.05	0.05	x^2
033	15	4.285714×10^{-3}	3500											0.05	0.05	0.05	0.05	0.05	x^2
034	156	3.1936735×10^{-2}	4900	.524	.677	.689	.693	.759	-11.38	-11.10	-13.21	-15.13	-6.12	0.01	0.01	0.01	0.01	0.01	o
035	101	1.6833333×10^{-2}	6000	.546	.548	.565	.570	.607	-8.73	-12.5	-14.9	-17.0	-8.1	0.01	0.01	0.01	0.01	0.01	o
036	48	1.20×10^{-1}	400	1.195	1.23	1.20	1.24	1.404	2.58	4.44	4.72	6.57	5.88	0.05	0.01	0.01	0.01	0.01	o
038	93	1.8712274×10^{-2}	4970	.832	.862	.903	.917	1.045	-3.10	-3.66	-3.18	-3.17	.903	0.01	0.01	0.01	0.01	---	o
039	12	4.80×10^{-3}	2500											0.05	0.05	0.05	0.05	0.05	x^2
043	34	3.3170732×10^{-2}	1025	.794	.783	.856	.878	.954	-2.30	-3.48	-2.85	-2.80	-.57	0.05	0.01	0.01	0.01	---	o
051	91	$2.5454545 \times 10^{-}$	3575	.699	.688	.758	.803	.845	-5.49	-8.35	-7.85	-7.41	-3.06	0.01	0.01	0.01	0.01	0.01	
052	24	$2.4973985 \times 10^{-}$	961											0.05	--	0.05	0.05	0.05	x^2
053	27	$9.440559 \times 10^{-}$	2860											0.05	0.05	0.05	0.05	--	x
055	43	$1.4930556 \times 10^{-}$	2880	1.091	1.311	1.283	1.415	1.635	1.14	5.62	6.30	10.73	8.78	---	0.01	0.01	0.01	0.01	
057	27	$2.5568182 \times 10^{-}$	1056											0.05	0.05	0.05	--	0.05	x
058	21	$7.291667 \times 10^{-}$	2880											0.05	0.05	0.05	0.05	---	x
059	76	$3.2986111 \times 10^{-}$	2304	.822	.836	.908	.922	.980	-2.96	-3.94	-2.74	-2.67	-3.57	0.01	0.01	0.01	0.01	---	
060	48	$3.3898305 \times 10^{-}$	1416	.570	.740	.739	.760	.810	-5.70	-4.96	-6.14	-6.55	-2.76	0.01	0.01	0.01	0.01	0.01	
061	47	$3.2638889 \times 10^{-}$	1440	1.67	1.54	1.48	1.44	1.48	8.73	10.14	11.17	11.80	6.75	0.01	0.01	0.01	0.01	0.01	
062	126	$1.20 \times 10^{-}$	1050	.874	1.147	1.207	1.184	1.257	-2.71	4.54	7.89	8.15	5.91	0.01	0.01	0.01	0.01	0.01	
063	58	$4.531250 \times 10^{-}$	1280	1.199	1.404	1.505	1.583	1.639	2.898	8.47	13.07	17.52	10.16	0.01	0.01	0.01	0.01	0.01	
064	78	$1.3109244 \times 10^{-}$	5950	.499	.676	.752	.766	.802	-.932	-7.89	-7.46	-8.15	-3.62	0.01	0.01	0.01	0.01	0.01	

Table 6.7 - continued

JM Site #	N	Density	Area (m^2)	R_n 1	2	3	4	5	C_n 1	2	3	4	5	r_n Level of Significance r_1	r_2	r_3	r_4	r_5	
066	39	1.95×10^{-2}	2000	.508	.525	.570	.549	.583	-5.87	-8.17	-9.12	-11.11	-5.51	0.01	0.01	0.01	0.01	0.01	σ
067	49	9.074074×10^{-3}	5400	.770	.836	.873	.889	.949	-3.08	-3.16	-3.03	-3.07	-.749	0.01	0.01	0.01	0.01	0.01	σ
068	118	8.251748×10^{-3}	14300	.526	.595	.644	.672	.724	-9.86	-12.12	-13.16	-14.06	-6.13	0.01	0.01	0.01	0.01	0.01	σ
069	93	1.1959877×10^{-2}	7776	.553	.687	.719	.723	.769	-8.24	-8.32	-9.23	-10.53	-4.58	0.01	0.01	0.01	0.01	0.01	σ
070	27	1.0825982×10^{-2}	2494											0.05	0.05	0.05	0.05	0.05	x^2
072	40	2.2727273×10^{-2}	1760	.739	.735	.798	.807	.824	-3.16	-4.62	-4.34	-4.81	-2.35	0.01	0.01	0.01	0.01	0.01	σ
073	93	2.906250×10^{-2}	3200	.710	.790	.790	.802	.882	-5.36	-5.58	-6.88	-7.53	2.34	0.01	0.01	0.01	0.01	0.01	σ
074	100	4.00×10^{-2}	2500	.635	.656	.740	.750	.794	-6.99	-9.49	-8.85	-9.86	-4.24	0.01	0.01	0.01	0.01	0.01	σ
075	154	7.9586563×10^{-2}	1935	.459	.590	.667	.674	.759	-12.83	-13.99	-14.07	-15.94	-6.08	0.01	0.0.	0.01	0.01	0.01	σ
076	70	3.5087719×10^{-2}	1995	.748	.809	.831	.832	.901	-4.03	-4.40	-4.79	-5.54	-1.72	0.01	0.01	0.01	0.01	0.01	σ
079	76	1.6888889×10^{-2}	4500	.440	.492	.583	.601	.655	-9.34	-12.2	-12.4		-6.23	0.01	0.01	0.01	0.01	0.01	σ
082	96	8.064516×10^{-3}	11904	.869	.978	.991	1.029	1.109	-2.46	-5.98	-.284	1.109	2.203	0.05				0.05	σ
084	34	4.358974×10^{-3}	7800	.405	.499	.518	.699	.700	-6.64	-8.05	-9.56	-6.91	-3.72	0.01	0.01	0.01	0.01	0.01	σ
085	80	5.701661×10^{-3}	14031	.920	.993	1.036	1.062	1.122	-1.372	-.179	1.110	2.181	2.247	--	--	--	0.05	0.05	σ
086	81	8.465719×10^{-3}	9568	.731	.782	.787	.829	.883	-4.63	-5.41	-6.53	-6.07	-2.17	0.01	0.01	0.01	0.01	0.05	σ
087	92	1.2445887×10^{-2}	7392	.565	.603	.666	.685	.735	-7.98	-10.49			-5.24	0.01	0.01	0.01	0.01	0.01	σ
088	92	1.0648148×10^{-2}	8640	.787	.854	.872	.902	1.029	-3.9	-3.85	-4.18	-3.71	.573	0.01	0.01	0.01	0.01	---	σ
089	52	9.027778×10^{-3}	5760	.656	.604	.625	.660	.701	-4.75	-7.86	-9.2	-9.66	-4.51	0.01	0.01	0.01	0.01	0.01	σ
090	93	3.10×10^{-2}	3000	.744	.789	.881	.865	.893	-4.72	-5.62	-3.91	-5.14	-2.13	0.01	0.01	0.01	0.01	0.05	σ
091	79	3.160×10^{-2}	2500	.815	.840	.826	.850	.981	-3.15	-3.92	-5.27	-5.24	-3.53	0.01	0.01	0.01	0.01	---	σ
092	87	2.1449704×10^{-2}	4056	.504	.540	.586	.625	.662	-8.86	-11.81	-1314	-13.79	-6.50	0.01	0.01	0.01	0.01	0.01	σ
093	51	3.2692308×10^{-2}	1560	.980	1.033	1.037	1.044	1.131	-2.74	.647	.895	1.249	1.956	--	--	--	--	0.05	σ

Table 6.7 - continued

JM Site #	N.	Density	Area (m^2)	R_n 1	R_n 2	R_n 3	R_n 4	R_n 5	C_n 1	C_n 2	C_n 3	C_n 4	C_n 5	r_n Level of Significance r_1	r_2	r_3	r_4	r_5	
094	56	5.333×10^{-2}	1050	1.029	1.057	.990	1.020	1.096	.420	1.174	-.245	.604	1.50	-	--	--	--	--	o
095	61	2.2101449×10^{-2}	2760	.705	.708	.739	.754	.823	-4.40	-6.29	-6.93	-7.57	-2.88	0.01	0.01	0.01	0.01	0.01	o
096	114	6.8468468×10^{-2}	1665	.619	.748	.749	.778	.844	-7.78	-7.40	-9.10	-9.35	-3.41	0.01	0.01	0.01	0.01	0.01	o
097	83	3.8676608×10^{-2}	2146	.840	.897	.868	.868	.904	-2.78	-2.59	-4.10	-4.73	-1.81	0.01	0.01	0.01	0.01	0.05	o
098	100	1.0915839×10^{-2}	9161	.443	.410	.391	.402	.443	-10.65	-16.25	-20.71	-23.58	-11.45	0.01	0.01	0.01	0.01	0.01	o
099	101	1.6833×10^{-2}	6000	.660	.750	.733	.880	1.029	-6.53	-6.92	-9.14	-4.77	.603	0.01	0.01	0.01	0.01	---	o
100	100	2.0×10^{-2}	5000	.646	.744	.767	.795	.876	-6.78	-7.05	-7.92	-8.10	-2.55	0.01	0.01	0.01	0.01	0.01	o
103	13	5.4621849×10^{-2}	238											0.05	0.05	0.05	---	---	x^2
106	16	2.0×10^{-2}	800											0.05	0.05	0.05	0.05	---	x^2
109	96	1.920×10^{-2}	5000	.582	.541	.622	.607	.635	-7.84	-12.39	-12.6	-15.2	-7.36	0.01	0.01	0.01	0.01	0.01	o
110	114	1.9853710×10^{-2}	5742	.118	.163	.201	.234	.268	-18.01	-24.62	-29.03	-32.26	-16.01	0.01	0.01	0.01	0.01	0.01	o
112	31	3.297872×10^{-3}	9400	.454	.534	.644	.656	.664	-5.81	-7.14	-6.74	-7.54	-3.998	0.01	0.01	0.01	0.01	0.01	o
113	60	7.894737×10^{-3}	7600	.669	.702	.831	.825	.863	-4.91	-6.36	-4.45	-5.34	-2.22	0.01	0.01	0.01	0.01	0.05	o
114	101	1.68333×10^{-2}	6000	.345	.363	.361	.341	.358	-12.6	-17.6	-21.8	-26.1	-13.2	0.01	0.01	0.01	0.01	0.01	o
115	100	$2.55102041 \times 10^{-1}$	392	.267	.424	.495	.547	.613	-14.02	-15.87	-17.17	-17.86	-7.96	0.01	0.01	0.01	0.01	0.01	o
116	100	2.5974026×10^{-2}	3850	.494	.546	.660	.672	.712	-9.68	-12.52	-11.56	-12.94	-5.92	0.01	0.01	0.01	0.01	0.01	o
117	101	5.7386364×10^{-2}	1760	.748	.879	.919	.965	1.065	4.85	-3.34	-2.75	-1.40	1.34	0.01	0.01	0.01			o
118	100	6.0790274×10^{-2}	1645	.605	.656	.665	.661	.726	-7.56	-9.48	-11.4	-13.4	-5.63	0.01	0.01	0.01	0.01	0.01	o
119	34	8.095238×10^{-3}	4200	.588	.654	.791	.850	.883	-4.59	-5.56	-4.14	-3.46	-1.45	0.01	0.01	0.01	0.01	--	o
120	17	4.121212×10^{-3}	4125											0.05	0.05	--	0.05	0.05	x^2
122	13	3.250×10^{-3}	4000											0.05	0.05	0.05	0.05	0.05	x^2

Table 6.7 · continued

JM Site #	N	Density	Area (m^2)	R_n 1	R_n 2	R_n 3	R_n 4	R_n 5	C_n 1	C_n 2	C_n 3	C_n 4	C_n 5	r_n Level of Significance r_1	r_2	r_3	r_4	r_5	
123	30	$1.6025641 \times 10^{-}$	1872											0.05	---	0.05	0.05	0.05	x^2
125	20	$4.1666667 \times 10^{-}$	480											0.05	0.05	0.05	0.05	0.05	x^2
126	67	$4.985119 \times 10^{-}$	13440	.571	.722	.930	1.00	1.03	-6.72	-6.26	-1.95	-.008	.505	0.01	0.01	0.05	---	---	σ
129	27	$2.3601399 \times 10^{-}$	1144											0.05	0.05	0.05	0.05	0.05	x^2
130	109	$3.2479142 \times 10^{-}$	3356	.770	.865	.893	.890	1.003	-4.59	-3.88	-3.79	-4.53	.054	0.01	0.01	0.01	0.01	---	σ
131	18	$2.337662 \times 10^{-}$	7700											0.05	0.05	---	0.05	0.05	x^2
132	95	$2.3602484 \times 10^{-}$	4025	.579	.613	.669	.704	.777	-7.84	-10.40	-10.99	-11.38	-4.47	0.01	0.01	0.01	0.01	0.01	σ
133	101	$1.4428571 \times 10^{-}$	7000	.579	.586	.596	.616	.663	-8.09	-11.4	-13.8	-15.2	-6.9	0.01	0.01	0.01	0.01	0.01	σ
134	150	$5.0 \times 10^{-}$	30000	.384	.430	.430	.438	.481	-14.4	-19.2	-23.7	-27.2	-13.0	0.01	0.01	0.01	0.01	0.01	σ
51	101	$6.5755208 \times 10^{-}$	1536	.762	.764	.808	.816	.882	-4.58	-6.54	-6.55	-7.29	-2.43	0.01	0.01	0.01	0.01	0.05	σ
154	63	$1.3671875 \times 10^{-}$	4608	.678	.747	.754	.833	.869	-4.89	-5.54	-6.65	-5.22	-2.17	0.01	0.01	0.01	0.01	0.05	σ

Key: ___ indicates ratio and C scores showing tendency towards perfect ordering

JM Site # : Temporary site identification number

N : Total number of artifacts

Density: Artifact density per square meter

Area: Total area of site

R_n : Nearest neighbor ratio value for first - fifth neighbor

C_n : Nearest nieghbor C score

Significance: Nearest neighbor statistical significance of analysis

σ/x : Indicates normal distribution (σ) and chi square (x^2) subprograms.

TABLE 6.8
DESCRIPTIVE STATISTICS OF NEAREST NEIGHBOR ANALYSES RESULTS

Level (r_n)	N	Clustered	Perfect Order	Not Significant
I	97	86	6	5
$\%f_1$	----	0.887	0.062	0.051
$\%f_2$	92	0.935	0.065	----
II	92	81	6	5
$\%f_1$	----	0.880	0.065	0.054
$\%f_2$	87	0.931	0.069	----
				$\Sigma = 39$
III	87	77	6	4
$\%f_1$	----	0.885	0.069	0.046
$\%f_2$	83	0.928	0.072	----
				$\Sigma = 14$
IV	83	68	6	9
$\%f_1$	----	0.819	0.072	0.108
$\%f_2$	74	0.919	0.081	
				$\Sigma = 23$
V	74	52	6	16
$\%f_1$	----	0.703	0.081	0.216
$\%f_2$	58	0.896	0.103	
				$\Sigma = 39$
$\bar{x}_1$	5	0.835	0.0698	
$\bar{x}_2$	5	0.923	0.078	
∂_1	5	0.0706	0.0066	
∂_2	5	0.0139	0.0136	

Key:
- $\%f_1$ Total percentage including non-significant sites
- $\%f_2$ Percentage frequency excluding non-significant sites
- $\bar{x}_1$ Means $\%f_1$
- $\bar{x}_2$ Means $\%f_2$
- ∂_1 Standard deviation of $\%f_1$
- ∂_2 Standard deviation of $\%f_2$
- Σ Equals sum of non-significant sites

Table 6.8 - Continued

DESCRIPTIVE STATISTICS OF NEAREST NEIGHBOR SIGNIFICANT SITES
BY LEVEL OF SIGNIFICANCE (∂)

Level (r_n)	N		Clustered ∂ = 0.01	Clustered ∂ = 0.05	N		Perfect Order ∂ = 0.01	Perfect Order ∂ = 0.05
I	86	n	58	28	6	n	4	2
		%f	0.674	0.326		%f	0.670	0.330
II	81	n	58	23	6	n	6	0
		%f	0.716	0.284		%f	1.00	
III	77	n	56	21	6	n	6	0
		%f	0.727	0.273		%f	1.00	
IV	73	n	54	19	6	n	6	0
		%f	0.740	0.260		%f	1.00	
V	59	n	31	28	6	n	6	0
		%f	0.525	0.474		%f	1.00	
Mean ($\bar{x}$):		n	51.4	23.8			5.6	0.4
		%f	0.6764	0.3234			0.934	0.066
∂ :		n	10.30	3.66			0.80	0.80
		%f	0.979	0.978			0.132	0.132

Key:
- N: Total number of significant sites
- n: Number of significant sites by significance level (∂)
- %f: Percentage frequency by significance level
- ∂: Standard Deviation (Sigma)

The results of these tests are presented in Table 6.9.

The first order test utilizes the noncumulative distributions of clustered (n_1), ordered (n_2) and random (n_3) sites. As is shown, the Chi-Square test is highly significant for levels r_1-r_5 of Nearest Neighbor. The x^2 values for n_1 range from 30.2 (r_5) to 89.3 (r_1). At all five levels, the x^2 value for n_1 are the highest values in the test.

The second order test is cumulative for n_3; it was felt that this would more realistically represent the distributions of n_1, n_2, and n_3. The results are again highly significant for r_1-r_5 with all probabilities <0.001. In the second order test, the x^2 values for n_1 range from 12.0 (r_5) to 73.4 (r_1). With the exception of r_5, these x^2 values are the largest values for n_1, n_2, n_3. (At r_5, the x^2 value for perfect order sites is the largest value: $n_2 > n_1 > n_3$.

The third order tests were done to check the significance of significant and nonsignificant sites. N_1 and n_2 were combined to further test the distribution of sites. Since the first and second order Chi-Square tests were highly significant for nonrandom sites (n_1 and n_2), a one-tailed binomial test was used to give more exact probabilities in support of the third order Chi-Square test. The one-tailed design is applicable because the test was specifically designed to examine the negative end of the distribution, as the variables are clustered and random (n_2 is constant for all levels at 6). As can be seen, the Chi-Square test is not significant at r_5; the one-tailed binomial, however, was significant with $p = 0.0336$ (> 0.05). Further support for the validity of the one-tailed design is given by the negative Z scores for r_i-r_5.

A fourth order test of Nearest Neighbor significant sites (clustered and ordered) was designed to elicit information regarding the level of significance for the sites. The distribution tested was between sites significant at $\partial = 0.05$ and $\partial = 0.01$. Both the Chi-Square test and the binomial test were utilized; the results are presented in Table 6.9. The results indicate that for levels r_1 - r_4, the majority of sites are significant at $\partial = 0.01$; however, at level r_5, there is no significant difference in the distribution of Nearest Neighbor sites at $\partial = 0.01$ and $\partial = 0.05$.

In the application of the theoretical model of artifact clusters representing task-activity areas, certain implicit assumptions are made. The foremost of these is that the archeological record is in fact representative of past human activities. In his discussion of this model, Schiffer (1976:12) points out three basic properties of archeological data.

1. Artifacts are in static spatial relationships,
2. They have been output from a cultural system,
3. They have been subjected to the operation of both cultural and natural transformational processes.

The first two points are present by definition of an archeclogical site. The third point, however, is a key stipulation in the analysis of any past cultural system through its physical remains. The archeological record, with rare exceptions, is subject to both pre and post-depositional transformations. Schiffer (1976:14-16) has termed these N- (natural) and C- (cultural) Transforms. N-Transforms are those natural factors which affect the archeological record, such as wind and water erosion, animal and plant disturbance, natural fires, etc. C-Transforms are human activities, such as selective removal of artifacts prior to site abandonment, postdepositional salvage/collecting (pot hunting), reoccupation by noncontemporary culture groups, etc.

TABLE 6.9
RESULTS OF TESTS OF SIGNIFICANCE FOR NEAREST-NEIGHBOR CLUSTERED, ORDERED, AND RANDOM SITES

Chi-Square

First Order: K = 3; Clustered (n_1), Ordered (n_2), and Random (n_3). Test is noncumulative for Random sites.

Level (r_n)	N	n_1	n_2	n_3	x^2	Critical value x^2 ($\partial = 0.05$)	df	Probability ($x^2 >$ Chi-Square)
r_1	97	86	6	5	133.8	5.99	2	$p < 0.001$
r_2	92	81	6	5	123.8	5.99	2	$p < 0.001$
r_3	87	77	6	4	119.2	5.99	2	$p < 0.001$
r_4	83	68	6	9	88.2	5.99	2	$p < 0.001$
r_5	74	52	6	16	47.5	5.99	2	$p < 0.001$

Second Order: K = 3; Clustered (n_1), Ordered (n_2, and Random (n_3). Test is cumulative for Random sites.

Level (r_n)	N	n_1	n_2	n_3	x^2	Critical value x^2 ($\partial = 0.05$)	df	Probability ($x^2 >$ Chi-Square)
r_1	97	86	6	5	133.8	5.99	2	$p < 0.001$
r_2	97	81	6	10	110.2	5.99	2	$p < 0.001$
r_3	97	77	6	14	93.6	5.99	2	$p < 0.001$
r_4	97	68	6	23	63.5	5.99	2	$p < 0.001$
r_5	97	52	6	39	34.8	5.99	2	$p < 0.001$

Third Order: K = 2; Significant (Clustered, Ordered) and Non-Significant (Random) sites ($N = n_1 + n_2$).

Chi-Square

Level (r_n)	N	n_1	n_2	x^2	Critical value x^2 ($\partial = 0\ 05$)	df	Probability ($x^2 <$ Chi-Square)
r_1	97	92	05	78.0	3.84	1	$p < 0.001$
r_2	97	87	10	61.1	3.84	1	$p < 0.001$
r_3	97	83	14	49.1	3.84	1	$p < 0.001$
r_4	97	74	23	26.8	3.84	1	$p < 0.001$
r_5	97	58	39	3.72	3.84	1	$0.10 < p > 0.05$

Table 6.9 - continued

Binomial

Level (r_n)	N	N_1 Significant	N_2 Cumulative Non-Significant	Z Score	Critical Value of Z ($\partial = 0.05$) (One-tailed)	Associated Probability
r_1	97	92	5	- 8.73	- 1.65	$p < 0.00003$
r_2	97	87	10	- 7.72	- 1.65	$p < 0.00003$
r_3	97	83	14	- 6.90	- 1.65	$p < 0.00003$
r_4	97	74	23	- 5.08	- 1.65	$p < 0.00003$
r_5	97	58	39	- 1.83	- 1.65	$p < 0.0336$

Fourth Order: Chi-Square and Binomial tests of the distribution of N.N. Significant Sites (Clustered and Ordered) by level of Significance: $\partial = 0.01$ (n_1) $\partial = 0.05$ (n_2)

Chi-Square

Level (r_n)	N	n_1	n_2	x^2	Critical Value of x^2 ($\partial = 0.05$)	df	Probability ($x^2 >$ Chi-Square)
r_1	86	58	28	10.46	3.84	1	$p < 0.001$
r_2	81	58	23	15.12	3.84	1	$p < 0.001$
r_3	77	56	21	15.9	3.84	1	$p < 0.001$
r_4	68	54	14	23.52	3.84	1	$p < 0.001$
r_5	52	31	21	1.92	3.84	1	$0.20 < p > 0.10$

Binomial

Level (r_n)	N	n_1	n_2	Z Score	Critical Value of Z ($\partial = 0.05$)	Associated Probability
r_1	86	58	28	- 3.13	- 1.65	$p < 0.00009$
r_2	81	58	23	- 3.78	- 1.65	$0.00011 < p > 0.00007$
r_3	77	56	21	- 3.87	- 1.65	$0.00007 < p > 0.00005$
r_4	68	54	14	- 4.73	- 1.65	$p < 0.00003$
r_5	52	31	21	- 1.25	- 1.65	$p = 0.1056$

These factors affecting the spatial and temporal relationships of artifacts are, for the most part, very difficult to assess. Certain transforms, such as stratigraphic inversion, are readily apparent and allowance may be made in analysis. Surface artifacts, however, are subject to many more diffuse and subtle transforms which are very difficult to identify as far as impact on the archeological record. It is clear, though, that the interrelation of processes involved is quite complex, and at this point, only very general assessments of N- and C-Transform impact may be made. The archeologist is left with estimation of site disturbance, and given an estimate of minimal disturbance, assumes that the artifact distribution maintains the same general spatial and temporal relationships as the preabandonment distribution.

The research approach to this study has provided a partial resolution to this problem. Utilization of the block data collection provides a large sample of sites from many differing topographic, geomorphological and other environmental settings. It may be reasonably assumed that postdepositional N- and C-Transforms are not consistent from site to site, and that in fact, these factors should vary as much (or more) as the environmental variables. Taking this assumption one step further, it should be reasonable to assume that a variable under analysis, giving consistent patterned (clustered) results between sites over a relatively large and varied research area, is not, in fact, an artifact of the statistic.

The results of the intrasite Nearest Neighbor analysis shows very high consistency for the presence of clustered artifact distributions over a relatively large study area. The interpretation, which may be stated with confidence, is that site clusters within the study area are generally representative of the preabandonment spatial relationships and are therefore generally representative of past human activities. The measurement of second through fifth Nearest Neighbor provides further support of this conclusion. The maintenance of statistical significance of clustering within the first Nearest Neighbor to the fourth Nearest Neighbor level (Table 6.9) shows very good consistency of internal clustering, and is a relatively good indication of the tightness of intrasite clusters. Even more support for this interpretation is provided by the NTSYS intersite analysis results (Section 6.4). These two independent analytical techniques maintain very tight consistency of interpretation from two different analytical approaches to the same data base.

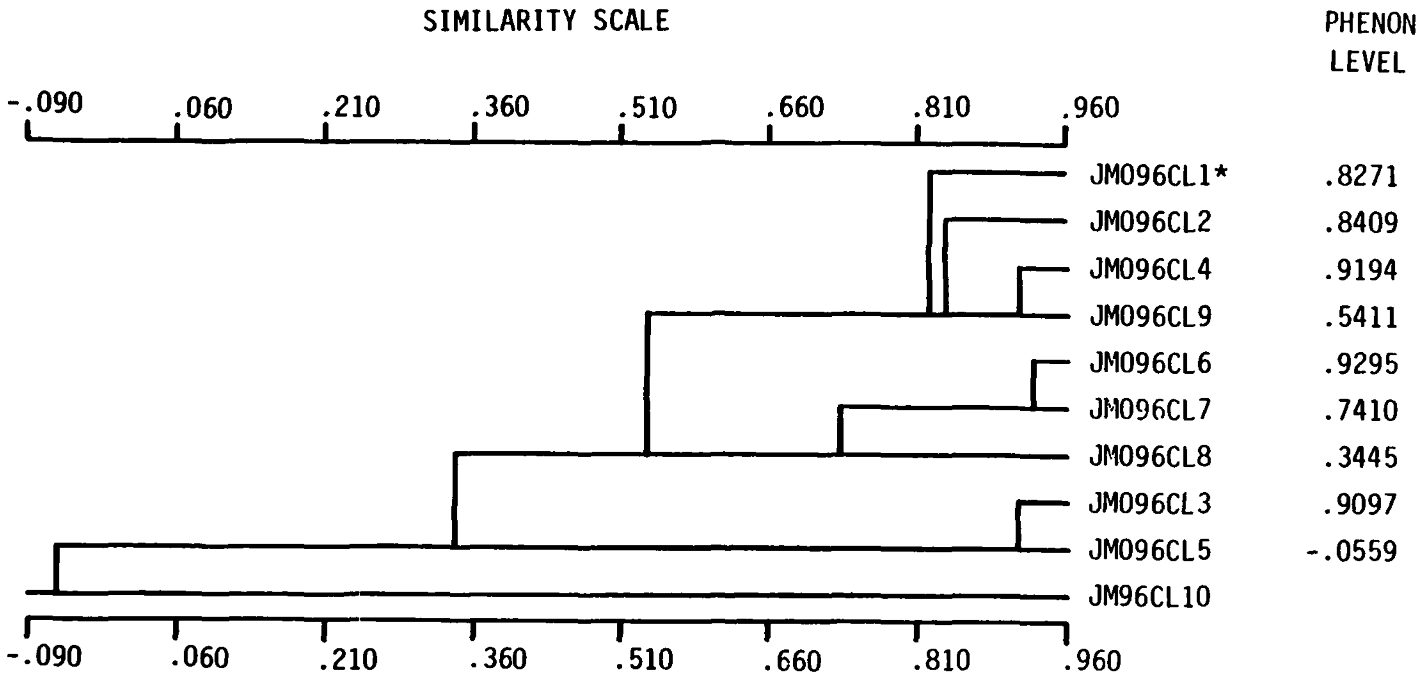
In conclusion, then, the research design, in combination with independent analytical approaches, has provided a realistic explanative model for the interpretation of the archeological record, as well as providing a solution to postdepositional disturbance of the data.

Using a Fortran program written by Richard E. Oberlin, percentage frequencies of specific tool types were determined for each cluster within a site. Clusters were defined using the Z-coordinate technique discussed below. Forty-nine variables were used, representing all specific tool types classed under the 22 general tool categories (Figure 4.6).

The results are a comparison of the similarity of each cluster, based on functional similarity (taxonomic distance) by artifact type. The results are used to test the hypothesis (H_o) of no significant functional difference between artifact clusters on a site (Figure 6.6).

The basis of defining 1_a clusters within a site is accomplished using the Z_c cluster technique. The Z_c values for each artifact on a site were factored by 10% (0.10) to produce Z_c values <1.0. The program defines segregate clusters on the basis of a block occurrence of 4 or more Z_c values <1.0. The decision to use a 10% factoring (instead of the 25% used on the Z_c maps) is a

FIGURE 6.6
NTSYS DENDROGRAM OF JM096 INTRA-SITE ARTIFACT CLUSTERS
JOHN MARTIN RESERVOIR PROJECT



* CI identifies artifact cluster number.

result of numerous runs using 75, 50, 25, 10, and 5% factors. A subjective assessment, 1b, showed that the 10% factor provided enough discrimination to separate the clusters sufficiently for the NTSYS analysis. Table 6.10 is a comparison of the number of clusters as defined by the program to the number visually apparent on the Z_c cluster maps. There is a fairly close agreement between the two definitions.

The NTSYS average-link and subsets cluster analyses were run on 65 of the 99 prehistoric sites. The remaining 34 sites had either one (19 sites) or two (15 sites) clusters. The NTSYS program could not be run on sites with two clusters, as the computations resulted in infinite operands.

Prior to the tabulation of the results, it was decided that the 50% similarity phenon line would be the cut-off value of functional similarity. The basis for this decision is that the analysis is an average-link clustering with a percentage similarity identity level (0-100). Therefore, clusters with $\geqslant 0.50$ similarity were considered functionally congruent clusters The subsets cluster analysis was utilized as a check on the average-link results.

Table 6.11 presents the results of the analysis, together with the deleted sites. Of the 65 sites analyzed, 41 (63%) had MXCOMP correlations of $\geqslant 0.80$. This represents a total statistical sample of 41% of the 99 prehistoric sites. As can be seen, the number of functionally dissimilar clusters is quite low; the 41 sites contained a total of 207 segregate clusters of wl··ch only 21 (10%) were functionally dissimilar.

The analysis was designed to determine whether there is a significant difference of cluster types (functionally similar/dissimilar) between site types. It was expected that base camps would show a higher diversity of both artifact types and dissimilar clusters, due to the more varied task-activities and seasonal occupation of the site. Special-activity sites were, on the other hand, expected to have less diversity as the task-activities carried out here would be more specialized, with artifact types reflecting this specialization. It was also felt that seasonal reoccupation of special-activity sites would tend to build functionally similar clusters of tool types over time, as would be expected if the same specialized task-activities were carried out at these sites.

In order to test the significance of the distribution of cluster types by site types, the Chi-Square test of significance (corrected for continuity) was employed in a 2x2 contingency table design. Tables 6.12 and 6.13 are the result of this test.

The first order test was performed using the number of sites (base camps and special-activity sites) that had similar/dissimilar clusters. The X^2 value of 2.36 had an associated probability of between 0.10 and 0.20; ($\partial = > 0.05$). The second order test utilized the number of similar/ dissimilar clusters by site type. As shown, this test was even less significant than the first-order test, with a X^2 value of 0.0142 and an associated probability of between 0.90 and 0.95; ($\partial = > 0.05$). Neither test was able to achieve significance; the null hypothesis of no significant functional difference of cluster types by site types is accepted.

It is possible that the research design used for this aspect of the analysis was not sensitive enough to determine cluster variability. It is also possible that the PNTDATA program is not defining actual clusters in space. And, of course, it is possible that the analysis reflects a true picture of the prehistoric inhabitants, and there is no significant functional variability on the intrasite level of artifactual distributions. Further analytical work is necessary to check these possibilities.

6.4. INTERSITE TASK/ACTIVITIES

Analysis of the between-site relationships was accomplished by means of two forms of

TABLE 6.10 COMPARISON OF THE NUMBER OF CLUSTERS DEFINED BY PROGRAM PNTDATA (Z_c[0.10]) AND THE Z_c MAPS (Z_c[0.25])

Site No.	PNTDATA	Z_c Map	Site No.	PNTDATA	Z_c Map
JM005	3	3	JM060	2	2
JM007	2	3	JM061	2	2
JM008	4	3-4	JM062	8	7
JM009	2	5	JM063	4	4
JM010	4	3-4	JM064	3	3
JM011	2	2	JM066	3	1-2
JM012	6	5	JM068	6	6
JM013	5	3-4	JM069	3	3
JM016	6	6	JM070	2	2
JM017	5	4	JM072	3	2
JM019	7	6	JM073	9	7
JM021	2	2	JM074	4	3-4
JM023	3	2	JM075	5	4
JM025	2	3	JM076	6	4
JM026	5	4-5	JM079	3	4
JM027	2	2	JM082	6	6-8
JM028	2	3	JM084	4	1 (N=34)
JM032	3	scatter	JM085	4	4
JM034	8	5	JM086	6	4-5
JM035	4	1	JM087	5	5
JM036	3	3	JM088	7	7-9
JM038	7	7	JM090	5	4-5
JM043	3	2	JM091	7	6
JM051	6	6	JM092	5	5
JM053	3	3	JM093	3	2-3
JM055	4	3	JM094	2	2
JM057	3	1	JM095	4	3-4
JM058	2	scatter	JM096	10	5
JM059	5	4	JM097	3	3
JM098	7	7	JM118	3	2-3
JM099	5	5-6	JM119	2	4
JM100	7	7	JM126	4	2-3
JM109	4	4	JM129	2	2-3
JM110	3	2-3	JM130	4	4
JM113	4	4-5	JM132	7	5-6
JM114	5	1-4	JM133	5	5-6
JM115	3	3	JM134	8	8-10
JM116	4	4	JM151	6	4-7
JM117	6	3-4	JM154	2	2-3

TABLE 6.11
RESULTS OF THE NTSYS INTRA SITE ANALYSIS

Sites With a MX COMP Correlation of < 0.80 Were Deleted From The Tests of Significance

Site Number	Site Type	n	Cluster Type: Similar	Cluster Type: Dissimilar	Analysis Type: Average Link	Analysis Type: Subsets	MXCOMP Correlations	Deleted
JM005	1.1	3	3	0	X		.723	X
JM008	1.4	4	2	2	X	X	.885	---
JM010	1.3	4	4	0	X	X	.982	----
JM012	1.3	6	5	1	X	X	.972	----
JM013	1.5	5	4	1	X	X	.876	----
JM016	1.3	6	5	1	X	X	.985	----
JM017	1.3	5	5	0	X	----	.773	X
JM019	1.3	7	7	0	X	----	.822	----
JM023	1.4	3	3	0	X	----	.732	X
JM026	1.5	5	5	0	X	----	.671	X
JM032	1.5	3	2	1	X	X	.721	X
JM034	5.1	8.	1	X	X	X	.784	X
JM035	5.2	4	4	0	X	----	.768	X
JM036	5.1	3	3	0	X	----	.787	X
JM038	7.1	7	6	1	X	----	.872	----
JM043	1.1	3	2	1	X	X	.990	----
JM051	6.2	6	5	1	X	----	.868	----
JM055	1.2	4	4	0	X	----	.967	----
JM057	5.2	3	3	0	X	----	.852	----
JM059	1.2	5	5	0	X	----	.986	----
JM060	3.0	3	3	0	X	----	.908	----
JM062	3.0	8	8	0	X	----	.688	X
JM063	3.0	4	4	0	X	----	.915	----
JM064	1.2	3	3	0	X	----	.976	----
JM066	1.4	3	3	0	X	----	.999	----
JM068	1.1	6	6	0	X	----	.830	----
JM069	1.2	3	3	0	X		1.00	
JM072	5.3	3	2	1	X		.687	X
JM073	5.3	9	9	0	X		.717	X
JM074	1.4	4	3	1	X		.661	X
JM075	5.1	5	5	0	X		.035	

Table 6.11 - Continued

Site Number	Site Type	n	Cluster Type: Similar	Cluster Type: Dissimilar	Analysis Type: Average Link	Analysis Type: Subsets	MXCOMP Correlations	Deleted
JM076	2.0	6	5	1	X	---	.919	---
JM079	2.0	3	2	1		X	.542	X
JM082	1.3	6	6	0	X	---	.887	---
JM084	4.0	4	3	1	X	X	.947	---
JM085	2.0	4	4	0	X	---	.970	---
JM086	2.0	6	6	0	X	---	.818	---
JM087	2.0	5	5	0	X	---	.924	---
JM088	5.2	7	7	0	X	---	.897	---
JM090	5.2	5	5	0	X	---	.835	---
JM091	5.2	7	7	0	X	---	.761	X
JM092	2.0	5	5	0	X	---	.841	---
JM093	5.2	3	3	0	X	---	.826	---
JM095	1.4	4	4	0	X	---	.839	---
JM096	5.2	10	8	2	X	---	.917	---
JM097	1.4	3	3	0	X	---	.603	X
JM098	5.2	7	7	0	X	---	.572	X
JM099	5.2	5	5	0	X	---	.700	X
JM100	2.0	7	7	0	X	---	.743	X
JM104	6.2	7	6	1	X	---	.875	---
JM108	7.2	4	4	0	X	---	.716	X
JM109	5.3	4	2	2	X	---	.979	---
JM110	7.1	3	2	1	X	X	.742	X
JM113	7.1	4	4	0	X	---	.829	---
JM114	7.1	5	5	0	X	---	.891	---
JM115	4.0	3	3	0	X	---	.711	X
JM116	5.2	4	4	0	X	---	.769	X
JM117	5.2	6	5	1	X	X	.814	---
JM118	6.2	3	3	0	X	---	.674	X
JM126	6.2	4	3	1	X	---	.948	---
JM130	6.2	4	4	0	X	---	.988	---
JM132	6.2	7	6	1	X	X	.863	---

Table 6.11 - Continued

Site Number	Site Type	n	Cluster Type: Similar	Cluster Type: Dissimilar	Analysis Type: Average Link	Analysis Type: Subsets	MXCOMP Correlations	Deleted
JM133	7.1	5	4	1	X		.749	X
JM134	7.2	8	7	1	X	X	.946	---
JM151	2.0	6	4	2	X	---	.969	---

Table 6.11 - B: One and Two Cluster Sites Deleted From NTSYS Intrasite Analysis

One Cluster Sites (19)	Two Cluster Sites (15)
JM014	JM007
JM018	JM009
JM022	JM011
JM024	JM021
JM030	JM025
JM031	JM027
JM033	JM028
JM039	JM053
JM052	JM058
JM067	JM061
JM089	JM070
JM103	JM094
JM106	JM119
JM112	JM129
JM120	JM154
JM122	
JM123	
JM125	
JM131	

TABLE 6.12
CHI-SQUARE TEST OF NUMBER OF CLUSTER TYPES BY SITE TYPE

Number of Clusters by Type	Base Camps	Special-Activity Sites	
Similar	46 (A)	140 (B)	186
Dissimilar	6 (C)	15 (D)	21
	52	155	207

$x^2 = 0.0142$ $(0.95 < p > 0.90)$ with df = 1)

TABLE 6.13

CHI-SQUARE TEST (Corrected For Continuity) OF NUMBER OF SITE TYPES BY CLUSTER TYPE

Computational Formula from Siegel (1956:107)

$$x^2 = \frac{N\left(AD - BC - \frac{N}{2}\right)^2}{(A+B)\ (C+D)\ (A+C)\ (B+D)}$$

Site Type

Number of Clusters by Type	Base Camps	Special-Activity Sites	
Similar	3 (A)	22 (B)	25
Dissimilar	6 (C)	10 (D)	16
	9	32	41

$x^2 = 2.36\ (0.20 < p > 0.10)$ with df = 1

computerized statistics, Nearest Neighbor and NTSYS (Section 4.3.1.3). A Fortran program was written by Richard E. Oberlin to provide the data base for the NTSYS intersite cluster analysis. The program copies the input data file, calculates percentage frequencies of tool types from the raw counts of nominal data codes, and writes these percentage frequencies on to data Records (Cards) 3 and 4, producing a completed master data file. The analytical categories are the 22 tool types defined in Section 4.3.3.1 (Figure 4.6). The results of this program were then used as the basis for the NTSYS analysis. Figure 4.11 is a flow diagram of the intersite programing sequence while the site clustering results are shown on Figure 6.7. The cultural interpretations, in terms of seven numbered functional site types, are discussed in Section 6.1.2.

The Nearest Neighbor analysis was performed on the 99 prehistoric sites to test the distribution of deviation from a random pattern. Program input utilized the northing and easting UTM's as the x, y grid coordinates for the measurement of first through fifth Nearest Neighbor.

The area of the survey comprises some 62,769,000 m^2 (24.2 m^2). However, due to area problems such as the presence of the reservoir, it was felt that the actual area would bias the statistic towards clustering. Therefore, a more conservative estimate of the area was used in the statistical calculations. The area used for the nn analysis is 23,309,892 m^2, which represents approximately 37% of the actual area surveyed and gives a site density of 4,247 x $10^{/6}$ sites/m^2. It should be noted that consistency must be maintained in the measurements used for the analysis: i.e., since UTM measurement is in meters, the area must be in square meters. The importance of a conservative estimate of area lies in the fact that, given a large enough area, even a random distribution will become significant for clustering. The results of the analysis are presented on Table 6.14. The results show that with ∂ set *a priori* at 0.05, the prehistoric sites are highly significant to level r_4 for clustering with R values $<$ 1.0, and negative C scores. This allows rejection of the null hypothesis, and acceptance of the alternative hypothesis of clustering (Section 6.5: Hypothesis 1.3).

Due to programming problems, a computer generated Z_c cluster map could not be produced for the intersite nn analysis. However, utilizing the Z_c values obtained for each site, it was possible to cluster sites by hand. The technique involves utilizing low Z_c values to define clusters. Table 6.15 shows the Z_c cutoff values, as well as the clusters defined by these values. The clusters were then color coded, and marked on the area map with an appropriately colored pin. Figure 6.3 shows the results of the clustering. The cluster map produced in this manner is a remarkably close fit to the NTSYS site typology (Figure 6.5) of base camps (Types 6 and 7) and special-activity sites (Types 1-5).

The Z_c cutoff values are arbitrary and were set at Z_c = 10$\mp$ 1.0. This value allows the inclusion of sites further from the nucleus of the cluster. It should be remembered that factoring the Z_c values to produce refined definition of the clusters would still produce clusters within the larger cluster area. At the intersite level of analysis, this refinement, combined with further analytical techniques, could probably provide more information regarding settlement patterns within the area. The Z_c area map is further support for the validity of the NTSYS typology in that the Z_c technique is based solely on proximity (distance),while the NTSYS analysis is based solely on functional variability of artifact types between sites.

6.5. EVALUATION OF HYPOTHESES

In this section we will examine each of the six functional hypotheses and evolutionary Pro-

FIGUR
SCHEMATIC DIAGRAM OF SECON
JOHN MARTIN RES

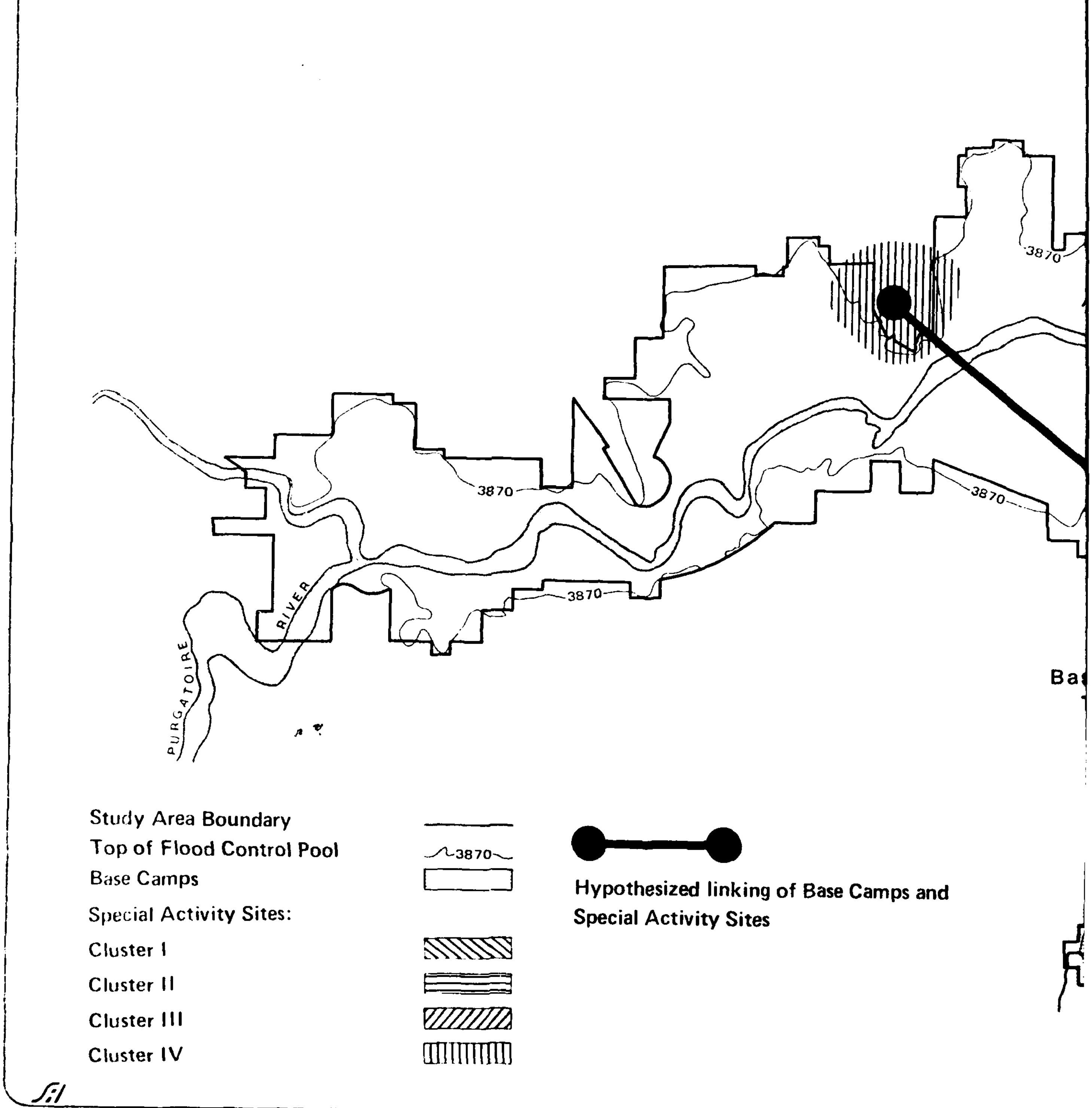
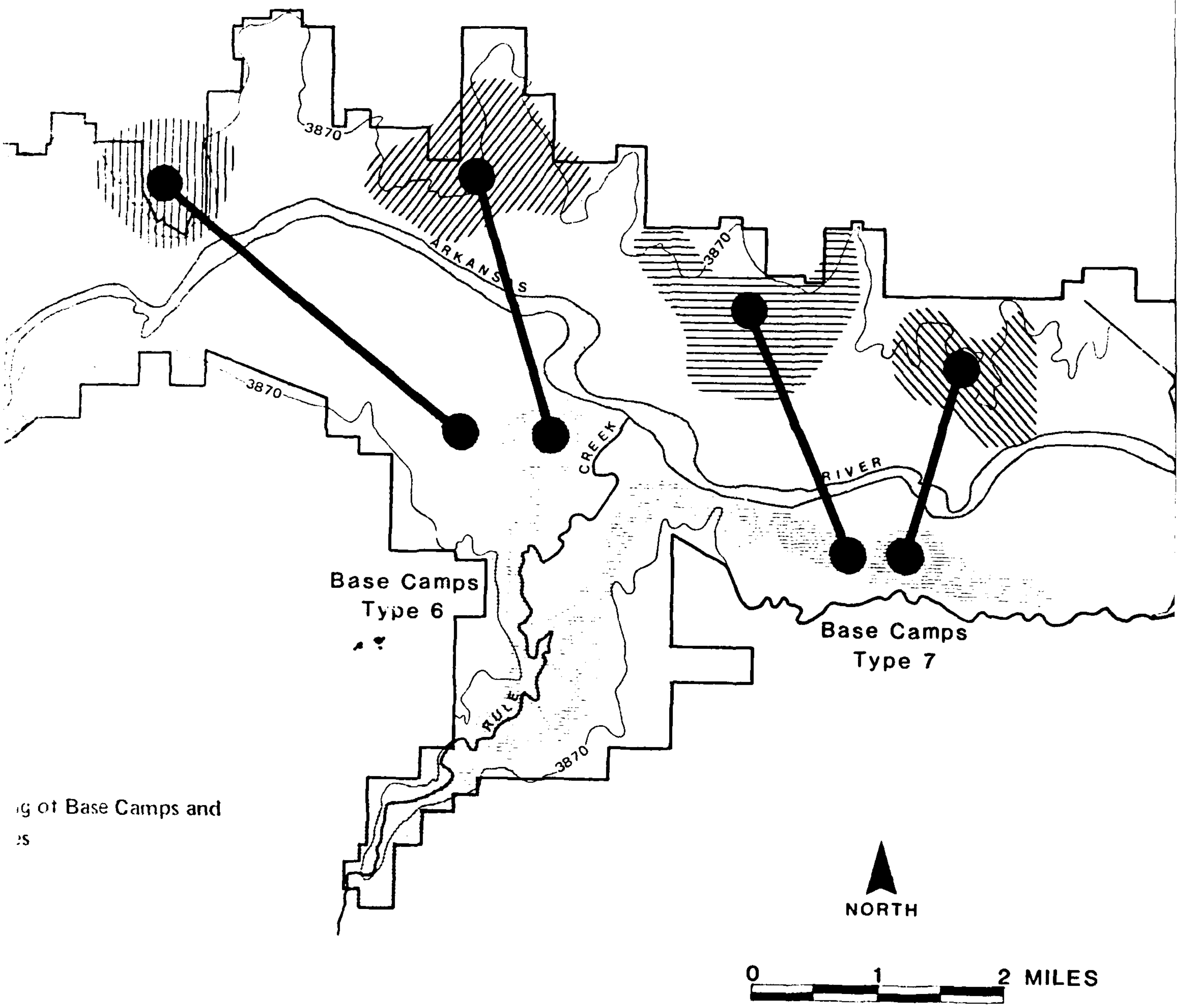


FIGURE 6.7

TIC DIAGRAM OF SECOND ORDER SETTLEMENT MODELING

JOHN MARTIN RESERVOIR PROJECT



ıg ot Base Camps and
:s

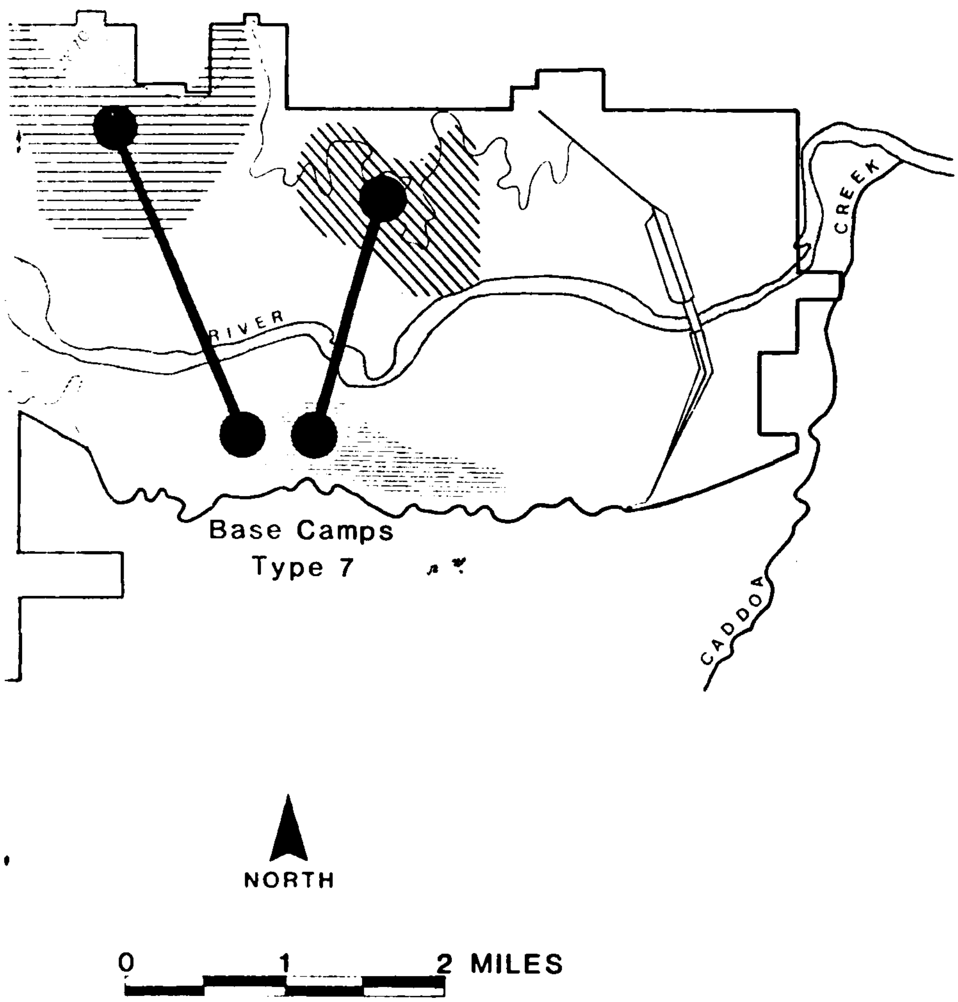

RIVER
CREEK
CADDOA
Base Camps
Type 7
NORTH
0
1
2 MILES

TABLE 6.14

RESULTS OF THE NEAREST NEIGHBOR INTERSITE ANALYSIS

Level (r_n)	R	C Scores	Level of Significance
r_1	.765	-4.47	< 0.01
r_2	.789	-5.79	< 0.01
r_3	.797	-6.86	< 0.01
r_4	.828	-6.74	< 0.01
r_5	.940	-1.23	> 0.05

*Note that the ratio values are < 1.0 and C scores are negative: The distribution is significant towards clustering.

TABLE 6.15
INTERSITE ANALYSIS OUTPUT GIVING LOCATIONAL DATA AND Z_c VALUES

Site No.	X	Y	Z*	Site No.	X	Y	Z*
JM005	42164.	678700.	14.8	JM074	421795	666650.	18.1
JM007	421550.	678460.	34.0	JM075	421775.	666800.	20.9
JM008	421556.	678340.	37.2	JM076	421793.	666840.	19.9
JM009	421579.	678480.	33.3	JM079	421753.	667080.	8.8
JM010	421605.	678400.	62.5	JM082	421766.	667780.	5.0
JM011	421625.	678300.	41.1	JM085	421948.	668860.	11.4
JM012	421625.	678300.	41.1	JM085	421948.	668860.	11.4
JM013	421644.	678340.	43.9	JM086	421825.	669320	6.3
JM014	421656.	678300.	38.9	JM087	421798.	669810.	12.6
JM016	421567.	677810.	14.3	JM088	421783.	670400.	10.6
JM017	421587.	677650.	16.0	JM089	421791.	670560.	12.8
JM018	421598.	678060.	16.9	JM090	421777.	670670.	13.9
JM019	421618.	677480.	19.4	JM091	421777.	670850.	14.9
JM021	421652.	677520.	18.5	JM092	421775.	670970.	15.1
JM022	421556.	677390.	17.0	JMO93	421792.	671400.	22.6
JM023	421669.	676790.	18.1	JM094	421813.	671440.	20.7
JM024	421661.	677120.	18.9	JM095	421836.	671380.	21.7
JM025	421611.	676640.	15.6	JM096	421898.	671690	11.3
JM026	421622.	677080.	21.2	JM097	421910.	671280.	17.2
JM027	421602.	677020.	19.3	JM098	421922.	671180.	15.6
JM028	421626.	676760.	18.8	JM099	421846.	672580.	9.9
JM030	421692.	676190.	9.9	JM100	421808.	672180.	10.2
JM031	421265.	671880.	11.4	JM103	421317.	678990.	8.0
JM032	421355.	671580	12.7	JM104	423888.	677170.	2.5
JM033	421503.	672710	11.8	JM106	421352.	677600.	12.6
JM034	421538.	672480	12.7	JM108	421361.	676600.	13.2
JM035	421533.	672360.	12.7	JM109	421357.	676900.	13.8
JM036	421537.	672140.	11.7	JM110	421359.	676315.	11.7
JM038	421525.	670720.	12.0	JM112	421355.	676140.	11.0
JM039	421503.	665440.	5.2	JM113	421380.	675980.	9.6
JM043	421435.	662390.	1.5	JM114	421377.	675140.	11.1
JM051	421692.	673260.	19.2	JM115	421400.	675290.	10.6
JM052	421704.	673240.	18.9	JM116	421431.	674538.	10.8
JM053	421761.	673420.	14.2	JM117	421431.	673920.	12.0
JM055	421754.	673870.	13.9	JM118	421319.	672920.	11.0
JM057	421671.	673970.	18.4	JM119	421202.	672898.	9.8
JM058	421668.	674020.	18.9	JM120	421102.	671930.	10.1
JM059	421654.	674120.	16.4	JM122	421089.	671430.	13.1
JM060	421572.	674180.	14.1	JM123	421044	671150.	11.1
JM061	421661.	674760.	12.1	JM125	421078.	671260.	12.3
JM062	421572.	674820.	12.8	JM126	421043.	670800.	9.9
JM063	421578.	675050.	13.1	JM129	421011.	670300.	13.9
JM064	421686.	675080.	11.9	JM130	421021.	670140.	13.9

Table 6.15 - continued

JM066	421654.	675540.	9.1	JM131	420951.	670070.	11.0
JM067	421720.	664700.	4.0	JM132	421047.	670480.	11.5
JM068	421719.	664910.	4.0	JM133	421049.	670230.	14.9
JM069	421779.	665540.	5.5	JM134	421142.	671520.	13.2
JM070	421829.	666420.	9.0	JM151	421818.	673390.	13.7
JM072	421833.	666800.	19.9	JM154	421828	669820.	12.5
JM073	421813.	666680.	19.3				

N = 99 Density = .000004247 Area = 23309892.. m^2

Cluster	Sites
I	JM005-JM038
II	JM051-JM066
III	JM070-JM076
IV	JM087-JM100
V	JM106-JM154

Key:
X = UTM northing
Y = UTM easting
Z = Z coordinate
-- = z_c cutoff values

*The clusters are defined by breaks in high values.

position 2, bringing to bear all of the univariate, bivariate, and multvariate analyses discussed above (Figures 4.5 and 4.10). In this manner, we will summarize the data analyses and seek solutions to the various research questions proposed in Section 4.3.2.

6.5.1 PROPOSITION 1 AND HYPOTHESES

Proposition 1 concerns the structure and function of human behavior on the landscape. It states that both natural resources and the nature of human social arrangements will define a distinctive pattern of adaptation; the fit between human behavior and the natural landscape (Section 4.3.2). During the planning stage of this research, it was anticipated that a sufficient number of sites would be dateable so that the functional hypotheses of Proposition 1 would be analyzed on synchronic data. However, the realities of the John Martin data have forced a revision of this procedure. Since only twelve sites could be dated at all, the functional analysis in fact was conducted on 99 prehistoric sites without time control. However, the limited chronological analysis of Section 5.4 does indicate that most of the occupation is late in the prehistoric sequence; late-Archaic through post-Archaic (Formative and Proto-historic Stages).

6.5.1.1 $H_{1.0}$

Hypothesis 1.0 is the null case in which there is no difference in the distribution, frequency, and association of environmental, artifact and site variables. By all statistical measures (R_n, Chi-Square, Pearson R, and NTSYS) the null hypothesis is rejected; there is nonrandom and uniform patterning in the data.

6.5.1.2 $H_{1.1}$

Hypothesis 1.1 predicts that small fly camps (special-activity sites) will exhibit close proximity to specific seasonal natural resources. The expectation was that such fly camps would be centrally located within one particular SCS range site habitat as a strategy to maximally exploit a particular or limited range of natural products. But, in fact, this prediction was not realized since it is the ecotones rather than the center of the range site habitat which are favored (Figure 6.1). Further, the special-activity sites, such as Site Types 1.0. 2.0, and 5.0, have revealed evidence of a range of task activities such as quarrying, primary core reduction, and hunting, as well as special and general processing of materials (Figure 6.5). Thus the hypothesis must be accepted in the sense that satellite camps were put out for particular tasks, but the range of activities is not nearly so limited as hypothesized, and the deployment location on the landscape is quite different than that originally predicted by the Research Design .

6.5.1.3 $H_{1.2}$

Hypothesis 1.2 predicts the nature and spatial location of base camps and/or villages. Since village aggregates of residences were not encountered on survey, we will evaluate this hypothesis only in terms of the base camp data (Figure 6.1). Fundamentally the predicted kinds of artifact types were found on large sites located near the river bottomland. There primary tool manufacture, tool maintenance, and repair activities are all indicated from these low elevation base camps, Site Types 6 and 7. However, the predicted locational strategy was not detected. Instead base camps were found centrally located within the SCS range site habitat where measures of ecotone proximity were all low.

6.5.1.4 $H_{1.3}$

Hypothesis 1.3 deals with expected complimentarity between and among sets of base camps and special-activity sites as schematically diagrammed on Figure 6.2. Here the prediction

was that the base camps would be occupied seasonally after which dispersal of the foraging band would send people to the fly camps during other seasons for a limited range of resource exploitation followed by reaggregation of the community at the base camp. The base camps are shown as symmetrically paired on either side of the river and centrally positioned within each SCS range site habitat (Figure 6.2). Networked into these base camps are upland special-activity sites located on the ecotone borders of adjacent range habitats. However, after the NTSYS analysis was completed (Section 6.1.2), the functional site types could be plotted on a reservoir map in order to reveal a second order and closer approximation of the actual settlement networking of the prehistoric community (Figure 6.7). The distributional patterning is very dichotomous; the base camps strongly favor the south bank of the Arkansas where they appear as a single large cluster defined by intersite Nearest Neighbor analysis (Section 6.4). One set of seven base camps is found flanking the main stem of the river, mostly between the mouth of Rule Creek and the damsite where they are almost entirely Site Type 7. A second set of 12, made up mostly of Type 6 sites, is present in the upper reach of Rule Creek within the COE fee land boundary. The entire base camp cluster is located close to perennial flowing water and stabilized dune fields, Range Sites 19 and 22, which are rich in large seeded grasses. Exploitation of these resources is indicated by the favoring of milling tools on these Type 6 and 7 sites (Figure 12.5).

In contrast, special-activity sites, Types 1 through 5, are largely distributed on the higher terraces found along the north bank of the river. Again Nearest Neighbor analysis of the intersite relationships shows that these special-activity sites cluster in four sets as diagrammed on Figure 6.7. That these dichotomous distributions are real rather than a chance phenomenon is shown by the Chi-Square two-by-two contingency analysis appearing on Table 6.16. Using Siegel's (1956:107) formula corrected for continuity, a Chi-Square value of 64.31 is calculated which is significant at less than 0.001 allowing us to reject the null Hypothesis 1.0 and accept the alternate hypothesis of significant association of site type with riverbank location. From this analysis, it appears that Hypothesis 1.3 can be accepted. Two complementary settlement patterns are present in which south bank base camps were networked to north bank special-activity sites. However, unlike the first approximation shown on Figure 6.2, this second order model indicates that the Arkansas River was not a barrier but that Archaic hunters and foragers regularly crossed and recrossed the river on a seasonal round (Figure 6.7).

6.5.1.5 $H_{1.4}$

Hypothesis 1.4 is concerned with artifact clustering within the site perimeter. The prediction is that nonrandom artifact clusters will be present as revealed by Nearest Neighbor and NTSYS analysis (Section 6.3). These internal artifact patterns, in turn, will express a distinctive pattern of task-activities. Given the seasonal round model developed in Hypothesis 1.3, two subhypotheses can now be formulated. One states that on a year-to-year basis, sites will be reoccupied for the same resource exploitation purposes and this repeated task-activity action will be expressed as a replication of the same set of tools. If internal artifact clusters are present on a site, then the tool content of each cluster will be a *duplicate* of every other artifact cluster on the site. The contrastive hypothesis is that internal artifact clustering will reveal distinctly different artifact sets indicative of a range of quite different task-activities. This latter hypothesis should be true of all of the site types but particularly so of the base camps, Types 6 and 7, which are characterized by a wide range of artifact types meaning a *diversified range* of task-activities predicted to be spatially segregated.

TABLE 6.16
CHI-SQUARE ASSOCIATION TEST FOR GENERALIZED SITE TYPES AS THESE ARE DISTRIBUTED ON THE NORTH AND SOUTH BANKS OF THE ARKANSAS RIVER

	Base Camps (Types 6 & 7)	Special Activity Sites (Types 1 through 5)	TOTALS
North side of river	3 3.03%	62 62.63%	65
South side of river	21 21.21%	13 13.13%	34
TOTALS	24	75	99

x^2 (corrected for continuity) = 64.31; df = 1; p = 0.001, Siegel 1956:107

As shown on Figure 4.5, two statistical measures were used to test multiple part Hypothesis 1.4. The Nearest Neighbor analysis with Z-coordinate cluster mapping allowed us to say definitely that many sites contain internal artifact clusters (Section 6.3). The second procedural step was to compare and contrast each artifact cluster with all others within the site using NTSYS. Results of this second analysis were also positive but in support of both of the subhypotheses: some artifact clusters are duplicates of each other as revealed by clustering at high phenon levels while other intrasite artifact clusters are distinctly different either not clustering at all or clustering with one another at a very low phenon level. These results demonstrate that Hypothesis 1.4 can be accepted; that is internal artifact patterning is present within archeological sites. Further, some of the patterning is due to spatial segregation of distinctively different task-activities and some due to annual reoccupation of the same site.

However, Hypothesis 1.4 must be accepted with some reservations. Analysis by Oberlin does not verify the expected relationships between base camps and many internally different artifact clusters on the one hand and many different artifact cluster duplicates on special-activity sites. Thus not all of the predicted relationships hold.

6.5.1.6 $H_{1.5}$

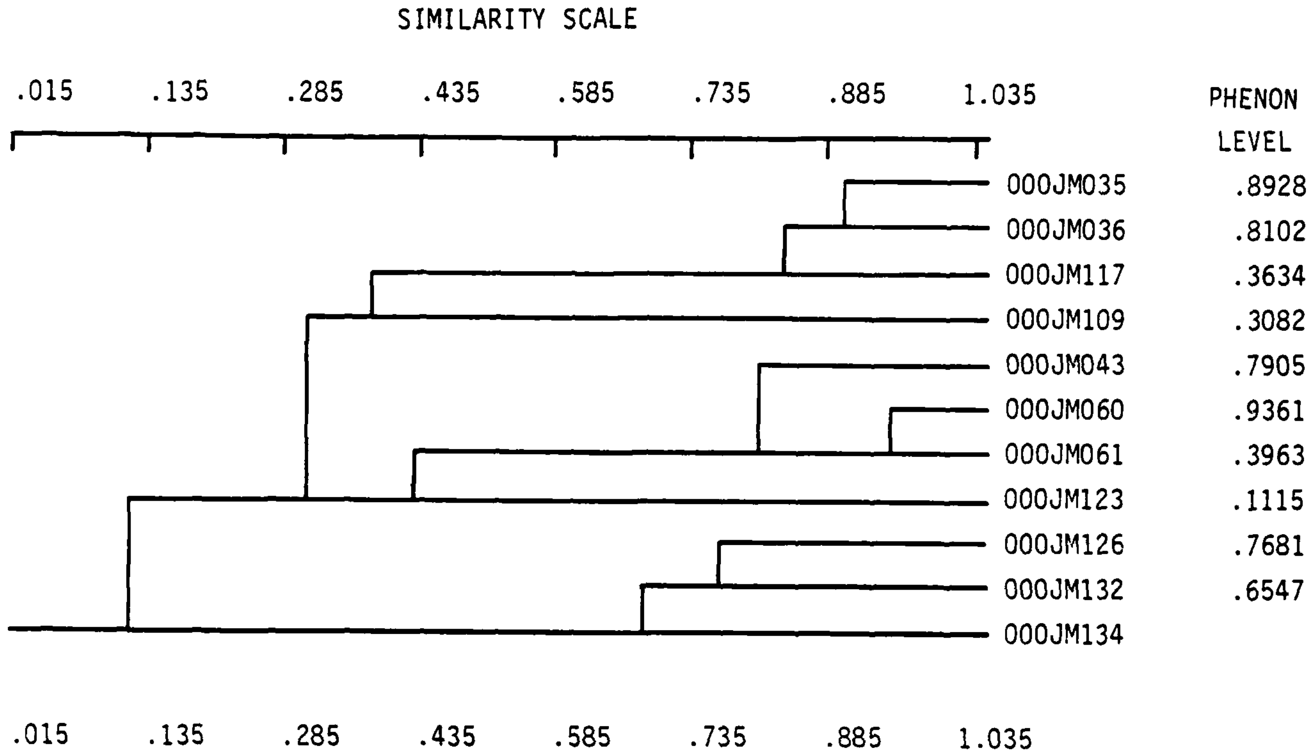
Hypothesis 1.5 is concerned with the human locational and organizational effect of the principal plant and animal subsistence resources. The prediction is that the behavior of the natural resources will in turn affect human behavior as to seasonal scheduling of settlement moves (Steward 1955). Further, the productive yield and preservability of these staple resources will determine the size, organization, and mobility patterning of the human predators.

Fortunately the range site data of the Soil Conservation Service provides very useful information as to potential native plants and animals so that our bivariate analysis allows us to say which site types are correlated or associated with which environmental variables. The results show that the north-of-river special-activity sites, particularly Type 1.4, were upland hunting camps for the taking of antelope, jackrabbit, and cottontail. In contrast, the south riverbank base camps, Types 6 and 7, were points of departure for riparian game such as deer, elk, cottontail, and waterfowl. Particularly, function Site Type 6.2 shows an association with bison which is thought to have foraged along the river according to the range site data. However, this SCS conclusion is contradicted by the Long expedition observations which reported bison herds on the prairie during the summer of 1820 (Section 3.1). Three other site types (1.3, 2.0, and 5.2) are interpreted as hunting camps from which their occupants employed a diversified strategy taking both upland and riparian game species.

Our analysis is far less specific about the staple plant resources. The Scattergram analysis does show that it is the base camps which associate with range site habitats producing a high standing crop yield; which is a conclusion contrary to our expectations about VAR20. Further, the presence of milling tools on base camps with an association of Site Type 7.0 and dune field habitat (SCS Range Site 19) points to a relationship between milling activities and the collection of large seeded grasses. However, this limited information does not assist us in interpreting the special material processing of the upland special-activity sites. We simply need more and different kinds of quantifiable data to extend these plant procurement interpretations.

In summary, we conclude that site types are in part interpretable according to the kinds and distribution of natural resources. Further, we

TABLE 6.17
DENDROGRAM OF DATED ARCHEOLOGICAL SITES USED IN TESTING EVOLUTIONARY PROPOSITION 2
JOHN MARTIN RESERVOIR PROJECT



SUBSET	MAXIMUM DIAMETER	MINIMUM GAP	ITEMS WITHIN SUBSET		
1	.936	.835	000JM060	000JM061	
2	.893	.821	000JM035	000JM036	
3	.746	.500	000JM043	000JM060	000JM061
4	.799	.500	000JM035	000JM036	000JM117
5	.768	.755	000JM126	000JM132	
6	.554	.412	000JM126	000JM132	000JM134

ITEMS NOT CLUSTERED 000JM109 000JM123

might speculate that the riverside base camps were fall and winter occupancy to account for the bison hunting and grass collecting conclusions. The upland hunting camps are then likely spring and summer stops in the seasonal round of settlement. It follows, then, that the foraging communities crossed the Arkansas twice annually in a north-to-south and lowland-to-upland transhumance pattern.

6.5.1.7 $H_{1.6}$

Hypothesis 1.6 is designed to satisfy the COE Scope-of-Services (Section 14) which requires a predictive model of site location. The hypothesis states that environmental variables, serving as resources or other kinds of determinants of site situation, will be predictive of site location. As posed in the hypothesis, it was expected that site location, site number (i.e. density), and functional site type would all be predictable if resource procurement were the primary prehistoric decision-making consideration in mapping out an annual settlement routing as outlined in Hypothesis 1.5. To solve the predictive modeling problem required by the COE contract, Multiple Regression was employed in which 12 environmental variables were used as independent predictors of site attributes (Section 6.2). Of many trials, only two variables (No. 36 and 37) were effective as dependent attributes, site density in a 1-km and 3-km circle (Table 6.5). From this analysis, it is predicted that site density increases as slope, height above intermittent drainage, percentage of dominant range site, aspect, standing crop yield, distance to Arkansas, distance to nearest intermittent drainage, and height above the Arkansas decreases. These negative correlations are in contrast to the set of direct relationships which say that site density is positively correlated with surrounding slope, distance to edge of range site, site elevation, and number of range sites in a 1-km circle. Of this set, distance to edge of range site, height above the Arkansas, and distance to the Arkansas, do not fit the Scattergram model of site location for special-activity sites. Several of these relationships are overturned when site density in a 3-km circle was predicted (Table 6.5). However, of the two models, the first is the more useful because of its greater areal precision and the fact that it is in more general agreement with the bivariate Scattergram model (Figure 6.1).

As pointed out in Section 6.2.2, the irony of the VAR36 Regression Model is that the predicted sites are the upland, north bank special-activity sites. It is these small sites which appear in high density while the low density base camps on the south bank of the river are not accounted for in the Regression Model. However, the data of the empirically derived Scattergram model of Figure 6.1 allows us to say rather precisely where the riverside south bank base camps are to be found which resolves our dilemma. Therefore, it is apparent that we can accept Hypothesis 1.6; site locations are determined by resource procurement activities so that environmental variables are *useful* predictors of site location, both for managerial and pure research purposes. Further, the number and kinds of sites are also predictable.

6.5.2 PROPOSITION 2 AND HYPOTHESES

Proposition 2 deals with patterns of both environmental and social adaptation as these have changed through time (Section 4.3.2.3). It is assumed that the emergence of new forms of adaptation will generate new cultural stages in the progression of Paleo-Indian, Archaic, and Formative. The eight evolutionary hypotheses generated from this proposition were written so as to account for the effect on artifact and site variables introduced by both favorable and unfavorable climatic changes as well as changes in the social environment such as trade, diffusion, and warfare. Our somewhat naive expectations were that a sufficient number of John Martin prehistoric sites would be dateable so

that Chi-Square and NTSYS analysis could be performed on the data by time period. In this manner, we could break out sets of archeological sites by climatic and cultural periods to measure stability and change through time as outlined in the Evolutionary Test Implications 2.0 - 2.8. In this discussion, it was assumed that sites of the same time period would show clustering at a high phenon level while sites of differing adaptive and historical traditions would show markedly different artifact content as expressed by cluster joining at a low phenon level.

At the time of the field investigations, stylistically distinctive pottery and projectile points were collected as reported in Section 5.3. These time-sensitive specimens were used to date 11 sites (JM081 was not included in this analysis) as listed on Figure 5.13 and Table 6.17. Because the sites are surface exposures and could have been occupied many times over, it was anticipated that each site in fact may be of several different ages. Further, the site dating seemed particularly risky since most sites produced only one time-sensitive specimen. However, despite these seeming drawbacks, an attempt was made to test the evolutionary hypotheses by running a dendrogram just on the 11 shakely dated sites. The results were far more gratifying than could have been expected as shown on Table 6.17. Here eight sites of the same time period are matched both in content (Table 6.18) and by time period. One site, JM060, is completely mismatched in that its tool content shows it to closely cluster with JM043 and 061 while its dating is far removed (Chronological Period 2 versus Period 5b). In addition, sites JM109 and 123 of early Archaic age, showed little formal affiliation with any other sites including each other having phenon levels of 0.1115 and 0.3082 (Table 6.18). But in the aggregate, sites within this small sample do show a decided correspondence between formal content and temporal age thereby showing support for the evolutionary proposition (No. 2).

6.6 SUMMARY

This section is organized by research themes dealing with settlement and subsistence variability. Conclusions obtained from these topical analyses feed into the evaluation of the research hypotheses, Section 6.5.

The first topic treated has to do with the functional site typology. This is performed by two kinds of statistics: bivariate and multivariate. Bivariate analyses dealt with correlation (Programs Scattergram and Nonpar Corr) statistics. These endeavors led to the definition of a generalized site typology consisting of two site types: base camps and special-activity sites.

A more refined site typology was performed by NTSYS, a form of multivariate statistics, used to compare all 99 of the sites comprising the computer file in order to cluster them by means of their artifact content. From this analysis, it was learned that the sites can be classified into seven numbered functional types. Some of these categories are further subdivideable. By examining the artifact content of the site loadings on each type and subtype, it was discovered that base camps are functional site Types 6 and 7 while the special-activity sites are Numbers 1 through 5.

The next research topic concerns factors which affect site location. Program Crosstabs was employed to determine which nominal environmental variables are significantly associated with which site types. Conclusions reached here show that special-activity sites located on the north side of the Arkansas are associated with Range Sites 6, 53, and 64. Some of these fly camps are upland hunting camps from which antelope, jackrabbit, and cottontail were taken. In contrast, base camp (Site Type 7) is located on the south bank of the river at low elevation where the stabilized dune fields of Range Site 19 were exploited. Site Type 6, another kind of base

TABLE 6.18
LIST OF DATED SITES (JM NO.) EMPLOYED IN TESTING
EVOLUTIONARY PROPOSITION 2

Site No. (JM No)	Phenon Level	Chronological Period*	Match	Mismatch	Site Type
035	.8928	5b	036	----	5.2
036	.8102	5a	035	----	5.1
117	.3634	5b	035, 036	----	5.2
109	.3082	1	----	----	1.4
043	.7905	5b	061	----	1.1
060	.9361	2	----	061	3.0
061	.3963	5b	043	----	1.4
123	.1115	1	----	----	6.0
126	.7681	5b	132	----	6.2
132	.6547	5b	126	----	6.2
134	----	3, 5a	126, 132	----	7.2

*See Figure 5.13

camp, was employed in the hunting of bison.

A second approach to the study of site location involved Multivariate analysis of the data performed by the Program Regression. This program was used to satisfy the COE contract stipulation for site predictive modeling. Twelve environmental variables were used to successfully predict site density. The multivariate Regression model also provided a check on the accuracy of the bivariate site typology model.

A Nearest Neighbor analysis was performed on the intrasite distribution of artifacts. This treatment allowed us to output Z-coordinate computer maps showing the actual spatial location of artifact clusters within each site. These artifact clusters were next compared with one another by means of the NTSYS program to define a pattern of cluster duplicates and cluster differences. By this means, two unnumbered hypotheses were tested contrasting annual reoccupation of sites as opposed to task-activity spatial differentiation within each site.

Spatial patterning among sites was next examined by means of Nearest Neighbor analysis. This intersite analysis demonstrated that four subclusters of sites were present north of the river and one to the south. When the NTSYS site typology was plotted on a reservoir map, it was found that one prehistoric community (site group) was present with base camps positioned south of the river and special-activity sites on the north side. It is likely that the river was twice annually crossed by prehistoric peoples during the course of a seasonal round.

Findings from the five research topics, site type, site location, intrasite task, and intersite task, were next used to evaluate the research hypotheses. The six functional hypotheses of Proposition 1 are all found acceptable but with reservations. Hypothesis 1.1 deals with special-activity sites (Types 1 - 5) which were occupied seasonally for the exploitation of particular resources such as game, lithics, and vegetable products. These fly camps were positioned on the uplands north of the Arkansas River near intermittent tributary drainages and the conjunction of many SCS range sites.

Hypothesis 1.2 is predictive of base camps. These sites (Types 6 and 7) are large in size and located near the river bottomland. They provided evidence of primary tool manufacture, tool maintenance, and repair activities. Base camps are located towards the center of SCS Range sites of high standing crop productivity.

Hypothesis 1.3 has to do with the networking of the two generalized kinds of sites: base camps and special-activity sites. The latter are thought to be sites of community aggregation during the fall and winter, whereas the fly camps witnesses dispersal of the band for spring and summer hunting activities.

Hypothesis 1.4 has to do with internal patterning in artifact distributions. Some of this clustering is due to seasonal reoccupation of the same site and some due to spatial differentiation of the many task/activities. However, it was not possible to accept the subhypotheses that base camps would show more internal differentiation of artifact clusters than special-activity sites.

Hypothesis 1.5 has to do with the effect of the staple food resources on the seasonality of occupation and scheduling of community mobility. It is tentatively concluded that hunting and plant foraging practices probably induced a seasonal transhumance pattern in which the prehistoric community crossed the Arkansas twice annually in a north-to-south and lowland-to-upland schedule.

Hypothesis 1.6 examines the predictive ability of environmental variables in specifying the number and location of prehistoric sites.

This management requirement was met using a multiple Regression program which accurately predicted special-activity sites but is of much less usefulness in its treatment of the base camps.

Proposition 2 has to do with diachronic patterns of evolution. But, in fact, much of this anticipated research was made mute due to the very low number of dateable sites; only 12 out of the computer file of 99 sites. However, despite the data limitations discussed in Section 5.4, the general proposition was supported. Sites of the same age contain similar artifact frequency content while sites of different ages do differ in content. And so, even though it is not possible to test each individual evolutionary hypothesis, the general culture change proposition is supported.

SECTION 7.0
HISTORIC RESEARCH DESIGN
by Paul D. Friedman

7.1 REGIONAL OVERVIEW

It was called by the first Spanish explorer to reach it, the "river Quivira," but later Spanish expeditions referred to it by the Indian name, Napestle. The French knew it as the Arkansas River. From the beginning of historic times the river served as a highway. Successive waves of people, from Native Americans to the Spanish, and from unknown American trappers and traders to well-known adventurers like John C. Fremont, travelled along that highway. The Plains Apache living as far away as Kansas followed the river on their way to trade at the pueblos of New Mexico. In 1706 the Spaniard Ulibarri was escorted by a native guide down this trail from the Apache village of La Jicarilla in New Mexico to the settlement of El Cuartelejo in western Kansas. A century later the American explorer Zebulon Pike journeyed up a well worn "Spanish Road" along the Arkansas River to the Rocky Mountains. By the 1820s this road had become part of the famous Santa Fe Trail.

To the Spanish the Arkansas River Valley appeared to be a lush and fertile land. They hoped that one day the native tribes could be induced to settle in agricultural communities there, acting as a buffer against encroachments on New Mexico's northern frontier. Americans who visited the region had a totally different perspective. Pike and Long both described it as a barren desert, certain to curtail further American expansion west of the Mississippi River.

During the era of the American fur trade in the far west, the Arkansas River Valley served as both a source area and a transportation and supply route. Just west of the project area, the firm of Bent and St. Vrain built their famous trading post in 1834. For almost 20 years Bent's Old Fort dominated the region. The fort developed a lucrative trade network with the Cheyenne, Arapahoe, and other tribes who utilized the Arkansas River Valley, influencing their pattern of settlement.

The fur trade also laid the seeds for the first experiments in Euro-American settlement in Colorado. Some trappers and traders started agricultural communities along the upper reaches of the Arkansas, at places like Pueblo and Hardscrabble. Although these first attempts at settlement failed, they proved that the Arkansas River Valley had agricultural potential.

It was the Gold Rush of 1859 which resulted in the permanent settlement of Colorado. But as the Euro-American population increased, conflict with Native Americans was unavoidable. This confrontation culminated in 1864 with the tragic massacre at Sand Creek, just east of the project area, of Cheyenne and Arapahoes. This signaled the end of Native American occupation in that region, and by 1869 most of the tribes had been removed to reservations in Oklahoma.

With the Native Americans gone, Euro-Americans moved into the area to take advantage of its natural attractions as an open range for stock raising. The open range cattle industry thrived until the hard winters of the late 1880s, government prosecution of illegal fencing activities, and increasing pressure from homesteaders, resulted in the break up of some of the big ranches. The arrival of the railroad, town building, and the opening of the public domain to homesteaders helped fill up many of the tracts within the project area. By the turn of the century, with the expansion of large-scale irrigation projects and the rise of the dry farming movement, farming took its place next to ranch-

ing as one of the most important economic activities in the area. Thus, as the Spanish had foreseen 400 years before, the Arkansas Valley emerged as a rich agricultural region.

It was the river, however, which always dominated the landscape. In 1921 the Arkansas flooded, and public reaction led to federal legislation calling for the construction of a dam for flood control and irrigation purposes. The 1930s was a difficult decade for residents of the area, as a drought and the Great Depression took their tolls. Many landowners welcomed the opportunity to sell out to the federal government. The site for the dam was near the town of Caddoa, and construction began in 1939. With the dam built and the reservoir filled, the story of the rich past of this area lay submerged, until now.

7.1.1 NATIVE AMERICAN OCCUPATION AND EARLY EXPLORATION

For thousands of years before the arrival of Europeans, the project area was occupied by a succession of aboriginal groups. The cultural sequence of this occupation has been discussed in Section 4.1. In historic times a great upheaval took place, as the introduction of the horse, the gun, and other European goods caused a shift in Native American populations which reverberated from Saskatchewan to Mexico. Within the project area Plains Apache were displaced by Comanche. Later the Comanche moved south of the Arkansas River, while Arapahoe and Cheyenne occupied the region north of it. These populations movements were observed and recorded by Europeans who began to explore this region.

The Spanish were the first people of European descent to visit the project area and record their impression of the native tribes living there. Spain claimed what is now southeastern Colorado as part of its New World empire. This region was treated as the northern frontier of New Mexico. In 1540 Francisco Vasquez de Coronado led a Spanish expedition northward out of Mexico in search of the legendary Seven Cities of Cibola. At the pueblos of New Mexico, he heard tales of a land called Quivira, so he took a small party there, crossing the plains of the panhandle of Oklahoma and Texas, and into Kansas. While on the plains, Coronado met several bands of nomadic natives; one group he called "Querechos" the other "Teyas." The Querechos he described as buffalo hunters. "These Indians," he wrote, "subsist... entirely on cattle (buffalo), for they neither plant nor harvest maize. With the skins they build their houses; with the skins they clothe and shoe themselves; from the skins they make ropes and also obtain wool" (Bolten 1949:246). The use of travois and dogs to pull their packs was noted. The Teyas were also described as buffalo hunters. Wedel (1959) identified both the Querechos and the Teyas as Plains Apache bands. Archeologically, Plains Apache occupation has been associated with the Dismal River Aspect (Gunnerson 1960). During the course of the cultural resources survey at John Martin Reservoir evidence was found of Dismal River attributes at several sites, indicating that this region was definitely occupied by Plains Apache during the time that the Spanish first began to explore it.

After Coronado, the Spanish ignored the northern frontier for more than 40 years, tending to matters in Mexico. But fear of French or English intrusions, and the hope of conquering and Christianizing the Pueblo Indians, led to plans of colonizing New Mexico. The initial movement in this direction was the expedition of Rodriguez and Espejo in 1581-1583. Their report about the settled pueblos and silver mines of New Mexico renewed Spanish interest in the area. Some who entered the new territory did so without official sanction. In 1590 Gaspar Castano de Sosa formed a party and attempted to conquer New Mexico. This adventure resulted in Sosa's arrest. In 1593 Francisco Leyva de Bonilla and Antonio Gutierrez de Humana led another unauthorized expedition to New Mexico. They may have passed through

the project area on their way down the Arkansas River. After reaching an Indian village, probably in Kansas, they continued on to another stream, perhaps the Platte River. During the trip Humana murdered Bonilla, and later the rest of the party was killed by Indians (Bolton 1908:201). This disaster gave the Purgatoire River its name. Because the Humana group perished near this stream, the Spanish called the river "El Rio de las Animas Perdidas en Purgatorio" (the river of souls lost in Purgatory). Later the name was shortened in popular usage to Las Animas by the Spanish, Purgatoire by the French, and Picketwire by early American settlers of the region.

The official contract to conduct the conquest and settlement of New Mexico was finally awarded to Juan de Onate by the viceroy of Mexico in 1595. Onate eventually set up his new capital in Santa Fe. With the colony established, Onate sent Vicente de Zaldivar out on the northern plains to hunt buffalo in September of 1599. There the Zaldivar party met the "Vaqueros" or herdsmen. These natives lived in skin tents, used dogs to pull their travois, and hunted buffalo. They also traded at the pueblos of Picuris and Taos. Most scholars agree with their identification as Plains Apache (Bolton 1908; Thomas 1935; Wedel 1959).

In 1601 Onate decided to personally head an expedition out into the plains, intending to discover a route to the South Sea. During the journey they came upon a rancheria of Indians they called "Escajaques." Like the Querechos described by Coronado, these people lived in tents of hides, and as Onate wrote, "They were not a people who sowed or reaped, but they lived solely on the cattle (buffalo)" (Bolton 1908: 257). The Escajaques were probably another group of Plains Apache. Earlier in his account Onate had observed, "At some places we came across camps of people of the Apache nation, who are the ones who possess these plains, and who having neither fixed place nor site of their own, go from place to place with the cattle always following them" (Bolton 1908:253). The Escajaques told Onate that the Humana party had been killed by their enemies a tribe that lived further east, which later scholars have identified as the Quiviras, previously visited by Coronado (Wedel 1959:21). Bolton believed the Quiviras were Witchita Indians residing in Kansas, and indicated that the Spanish called them Jumano and the French knew them as Panipiquet. Onate wrote that the Quiviras lived in grass huts and grew maize. On his way to Quivira, led by the Escajaques, Onate probably followed the route taken by Humana along the Arkansas River, and may have passed through the project area. The Quiviras did not appear to be friendly, so Onate started back to Mexico. On the return the Escajaques suddenly turned hostile and a battle was fought.

The seventeenth century was a time of unrest among the Pueblos. Some time around 1664 a group of Taos Indians fled northeast to Apache country. The Spanish governor of New Mexico dispatched 20 soldiers and some Indian allies under the command of Juan de Archuleta to retrieve the Taos rebels. Although Archuleta himself did not record the journey, the event was chronicled a century later by Father Escalante. Archuleta found the Pueblo Indians living with the Apache at a place which later became known as "El Cuartelejo." He observed that they had "kettles and other pieces of copper and tin" which were said to have come from Quivira. It was also learned that the Pawnee were trading at that time with the French (Thomas 1935:53). Thomas (1924) believed that the Archuleta Party was the first Spanish expedition to penetrate into Colorado. It is very possible that the route taken followed the Arkansas River, through the project area.

In 1680 the Pueblo Indians rose in open revolt and drove the Spanish out of New Mexico. Between 1692 and 1696 this territory was once

again put under Spanish rule by the reconquest of Diego de Vargas. In the fall of 1696 some Taos and Picuris Indians refused to submit to Vargas and fled to the plains, where they were taken captive by the Apache. When Don Lorenzo, the Picuris chief, sent a messenger to Santa Fe to report that the Pueblo Indians wanted to return to New Mexico, the governor appointed Ulibarri to rescue them. With 40 Spaniards and 100 Indians, Ulibarri departed from Taos on July 13, 1706. During the trip, Ulibarri met several different Apache tribes, including the Jicarillas, Flechas de Palo, Carlanas, and Penxayas. Although earlier Spanish expeditions had described the Plains Apache as nomadic buffalo hunters without knowledge of agriculture, Ulibarri found them settled at rancherias where they grew corn, frijoles, and pumpkins. These Apache complained to Ulibarri about attacks upon them by Utes and Comanches. Traveling northward, Ulibarri reached the Arkansas River near the present day town of Pueblo. From there the group followed the river eastward, and this route, no doubt, took them across the project area.

Arriving at the Apache village of El Cuartelejo, Ulibarri took possession of the province for his king in an official ceremony. He noted that the Apache grew crops such as corn, watermelons, pumpkins, and kidney beans, and were inclined towards accepting christianity. The people of El Cuartelejo hoped the Spanish would help them fight against their enemies, the Jumanos (Witchita) and the Pawnee. From the Apache, Ulibarri learned of French activity in the area. In a recent battle a white man and woman were killed by the Apache, and a gun, powder, a kettle, and a red cap were taken. The gun was shown to Ulibarri and identified as French. The Apache also told him that the Pawnee traded Indian slaves to the French. Having gathered together the Picuris Indians from El Cuartelejo, and other nearby vilages, Ulibarri returned to New Mexico (Thomas 1935).

There has been some debate over the exact location of El Cuartelejo. The historians Hubert Bolton and Alfred Thomas believe it was situated in either southern Lincoln County or western Kiowa, County in southeast Colorado, based upon the Ulibarri itinerary. Archeologists contend that an archeological site on Ladder Creek in Scott County, eastern Kansas, first excavated by Williston and Martin of the University of Kansas in 1898, represents the remains of El Cuartelejo. This site was re-investigated by Waldo Wedel in 1939, who found it had pueblo type architecture and a cultural component identified as Dismal River Aspect. It was dated to approximately 1700 A.D. The pueblo influence in the architecture, the Plains Apache cultural assemblege, and the date of occupation convinced Wedel that this site must have been El Cuartelejo (Wedel 1959). Ulibarri had commented that the Picuris Indians came to see him out of "the huts or little houses." Escalante, who described the Archuleta expedition, noted that the houses at El Cuartelejo had been built by Pueblo Indians. One of Ulibarri's men testified 13 years after the expedition that he had seen at El Cuartelejo "some ruins which according to the reports were made a long time ago by the Taos tribe" (Thomas 1935:68). These references indicate that the Pueblo Indian built pueblo-style houses at this Apache village.

Ulibarri had been the first to record the entrance of the Ute and Comanche to the region in 1706. As their raids against the Apache increased, the Spanish authorities in New Mexico became concerned. In July of 1719 the Comanche murdered some inhabitants of Taos and Cochiti. Governor Antonio de Valverde called a council of war and prepared for a campaign against them. Valverde's expedition left Taos on September 20, 1719 and followed the route earlier taken by Ulibarri. At La Jicarilla the Apache complained to the Spanish about the Ute and Comanche raids upon their villages. Traveling on to the rancheria called La Flecha, Valverde noted that the Apache grew maize, frijoles, and

squash. He also observed that some of the Apache villages had adobe houses, indicating the influence of pueblo styles of construction. From chief Carlana of the Sierra Blanca Apache, Valverde heard more stories of attacks by Utes and Comanches. Wishing to visit El Cuartelejo, Valverde continued northward and eventually arrived at the Arkansas River near the location of the John Martin Reservoir. Along the way they saw signs of Comanche camps, but the raiders were never encountered.

On the Arkansas River Valverde met with Indians from El Cuartelejo who told him more about French activity in the region. One of the Apache chiefs had a gun shot wound. He said that his tribe was attacked by Pawnee, Jumanos, and French. "The French have built two large pueblos," Valverde wrote in his diary, "each of which is as large as Taos. In them they live together with the said Pawnees and Jumanos Indians, to whom they have given long guns which they have taught them to shoot. With one of these they have wounded him." According to Thomas the wounded chief was probably a Paloma Apache. His village may have been located along the South Platte River. The Paloma were driven from their land by the Pawnee armed with French guns, and went to live on the Arkansas River near El Cuartelejo (Thomas 1935).

With water scarce, winter approaching, and no Comanche in sight, Valverde decided to return to New Mexico. The word he brought back about French intrusions into the northern frontier of Spanish territory caused a sensation. Following a council of war the viceroy in Mexico City recommended that a presidio be established at El Cuartelejo and an expedition be organized to reconnitre the French position in the northeast. Governor Valverde of New Mexico suggested that La Jicarilla would be a better location for a presidio, and gave the assignment of searching for the French to his lieutenant-governor Pedro de Villasur.

The Villasur expedition left Santa Fe in late June or early July of 1720. Their route is unknown, but they probably followed the Arkansas River to El Cuartelejo, just as Valverde and Ulibarri had done. Such a journey would have taken them through the project area. At El Cuartelejo, Villasur turned north and headed to the Platte River. There a Pawnee village was sighted. The Spanish crossed the North Platte River to meet with the Pawnee. The Pawnee were not friendly, and the interpreter the Spanish had sent was seized and held captive. After giving the Pawnee a note to the French, Villasur had his men fall back to the south side of the North Platte. The next morning they were attacked by Pawnee and French, and most of Villasur's command was killed. The survivors made it to New Mexico in September and brought news of the massacre to Valverde (Thomas 1935).

The repercussions of the Villasur expedition were that the viceroy sent Pedro de Riveria to New Mexico to investigate the affair. Charges were pressed against Valverde, who was removed from office and fined for handling the project so poorly. Rivera also ruled against establishing a presidio at La Jicarilla. Thus the extension of Spanish settlement north of New Mexico received its death blow.

But while the Spanish were concerned with protecting their northern frontier in the New World, the French were attempting to expand the western limits of Louisiana. In 1718 La Harpe ascended the Red River. He was followed by Du Rivage and Du Tisne, who reached the Painipiquet, or Jumano, villages on the Arkansas River in Oklahoma. Later, La Harpe reestablished this post on the Arkansas (Bolton 1964). In 1723 De Bourgmont built Fort Orleans on the Missouri River. The next year Bourgmont led an expedition westward to make peace with the Padouca Indians living in Kansas and Colorado.

Hyde (1959) identified the Padoua as Plains Apache. Along the way Bourgmont fell ill and returned to the Missouri, sending one of his men ahead to make contact with the Padouca. In the fall of 1724 Bourgmont again attempted to reach the Padouca villages, which he found in the vicinity of Ellsworth, Kansas (Folmer 1937:123). The Padouca indicated to De Bourgmont that they regularly traded with the Spanish in New Mexico.

The Spanish soon got word of the French advances. In 1726 a group of Escalchufines and Paloma Apache, fleeing from the Commanche, told Rivera that there were Frenchmen with their enemies. A later conversation with a female Comanche captive revealed that there were indeed Frenchmen among the Comanche, and they had built walled houses near El Cuartelejo. In 1727 Governor Bustamante of New Mexico wrote to the viceroy in Mexico City that he had heard reports of 6 Frenchmen at El Cuartelejo, and others on the Rio de Chinali. Bustamante also reported that the French at El Cuartelejo were arming the Apache to fight against the Comanche (Thomas 1935:46). Thomas (1940:14) speculated that these Frenchmen may have been part of the Bourgmont expedition of 1724 which reached the Plains Apache in Kansas. In any case, by arming the Apache, the French alienated the Comanche, and were thus effectively blocked from advancing any further west. At this time the Spanish documents clearly show that the Comanche were driving the Apache southward, out of the region around the project area.

The French were not able to pass through the Comanche barrier until 1739. By that date the Comanches had consolidated their control of the region along the Arkansas River, and probably felt that with the Apache in retreat they would benefit from trade with the French (Thomas 1940:16). 1739 is significant because that year the Mallet brothers led the first successful French trading expedition to New Mexico. Starting from the Missouri River. Paul and Pierre Mallet and their companions headed west along the Platte River, then turned south to the Arkansas River, where they found stones with Spanish inscriptions. The Mallets met a band of Comanche on the Arkansas, and an Arikara slave among the tribe showed them the way to New Mexico. While traveling up the Arkansas River it is very possible that the Mallet expedition passed through the project area.

The Mallet party stayed in New Mexico for several months, disposed of their merchandise, and then secured permission to leave. According to French and Spanish documents, two of the Frenchmen decided to stay in New Mexico while seven others departed from Pecos down the Canadian River to the Arkansas River. Here the group divided, three going to the Pawnee villages and then to Illinois, while the other four journeyed to the Mississippi River and New Orleans (Folmer 1939).

The Spanish authorities were not happy with French movements into their northern frontier. They had enough problems handling the Comanche without having them armed by the French. In retrospect, a later Spanish governor of New Mexico commented in a letter to the viceroy about the policy of his predecessor. Governor Mendoza, in permitting the Mallets, "who were the first who entered," to return to Louisiana. "I regard as most mischievous the permission given to the first Frenchmen to return," he wrote, because, "they gave an exact account and relation, informing the Governor of Louisiana of their route, and the situation and conditions of New Mexico" (Bolton 1964:161). Thus future French expeditions to New Mexico were received with suspicion.

The French, for their part, continued to try and keep the route to New Mexico open. In 1741 Governor Bienville of Louisiana sent a messenger to New Mexico, guided by four

members of the Mallet party, but the attempt was not successful. Next the French erected Fort Cavagnolle on the Missouri River, and around 1747 negotiated a treaty with the Comanche and Jumano. In 1748 the Spanish heard that 33 Frenchmen had arrived at a Comanche village on the Jicarilla River and traded guns for mules. Armed with French weapons, the Comanche began raiding Spanish settlements, attacking Pecos and Galisteo several times between 1744 and 1749. In 1749 the Comanche conducted three Frenchmen to the Taos fair, where they were arrested by Spanish authorities. These men had deserted from a French trading post among the Arkansas Indians and had followed the Arkansas River to Comanche country, perhaps travelling through the project area during their journey (Bolton 1964).

Other parties of Frenchmen attempted to reach New Mexico. In 1750 three French fur traders arrived there, having taken the Arkansas River route. In 1751 four more Frenchmen reached New Mexico from the Missouri River, although the circumstances of their journey is not known. The French effort to open trade relations with New Mexico culminated with the arrival of Jean Chapuis and Luis Feuilli in 1752 at Pecos. Chapuis, the leader of the expedition, had semi-official sanction to visit the Spanish, having secured a passport at Michillimackinac and a trading license at Fort Chartres. Originally eight other men were involved in the venture, and Feuilli joined it at the Kansas villages. The other eight men eventually turned back, and only Chapuis and Feuilli continued on to the Comanches, who made them pay to pass through their territory, and to New Mexico. There the two Frenchmen were arrested and their goods confiscated (Bolton 1964).

French and Spanish competition for control of the country north of New Mexico ended in 1763 when the French ceded the Trans-Mississippi half of Louisiana to Spain as one of the conditions of the Peace of Paris. Spanish troubles controlling the native tribes on the northern frontier continued, however. Before about 1747 the Ute and Comanche had been comrades in arms, and were almost always discussed as allies in the Spanish documents. But after 1749 the Spanish noticed that the Ute and Comanche turned against each other. The Apache also caused some problems (see Thomas 1940). Comanche raids in New Mexico occurred sporatically until 1779 when Governor Juan Bautista de Anza led a military force and defeated them at a battle fought near Greenhorn Creek in southern Colorado. Governor Anza later smoothed relations between the Ute and Comanche, and even attempted to convince the latter to give up their nomadic habits in exchange for a more settled life. In 1787 the Spanish tried to establish an agricultural community for the Comanche in the Arkansas Valley, probably near modern day Pueblo, but the experiment failed.

Spain held political control over Louisiana until 1800 when the French reacquired it. In 1803 this vast tract of land west of the Mississippi River was sold by Napoleon to the United States of America. At that time the actual southern border of the territory was undetermined, although it was generally agreed to be the Arkansas River.

The United States government wasted little time in sending out expeditions to ascertain the extent of the new acquisition. In 1803 Lewis and Clark went west to study the northern portion of Louisiana as far as the Pacific Coast. In 1806 Lieutenant Zebulon M. Pike was given a similar assignment in regards to the southwestern boundry of the territory. Pike's orders were to lead an expedition to the headwaters of the Arkansas River, make contact with the Comanche who inhabited that region, and then proceed south to explore the Red River. The Pike party headed westward along the southern bank of the

Arkansas River. Spanish authorities in New Mexico, hearing of Pike's journey, sent a military force out to turn him back. At a Pawnee village in Kansas, Pike was informed that a troop of 300 Spanish soldiers had been as far as the Sabine looking for him. Pike indicated that the Spanish were familiar with this region, for he commented that his company traveled by the "Spanish Road" along the Arkansas. For example, on September 25, 1806 Pike wrote in his journal, "We marched at a good hour, and in about eight miles struck a very large road on which the Spanish troops returned and which we could yet discover the grass beaten down in the direction they went" (Jackson 1966 vol. 1: 321).

It is significant to note that Pike first saw the Rocky Mountains while traveling through what is now the John Martin Reservoir Project Area. On November 15, 1806 he wrote, "At two o'clock in the afternoon I thought I could distinguish a mountain to our right, which appeared like a small blue cloud." This was Pike's Peak. Pike continued, "When our small party arrived on the hill they with one accord gave three cheers to the Mexican mountains" (Jackson 1966 vol. 1:345).

The sketch maps in the back of Pike's notebook provided some interesting information. The Purgatoire River was called "1st Fork," while Rule Creek was labeled "Look bute Creek," and Caddoa Creek was named "Buffalo Creek." Just west of Caddoa Creek was the inscription "Sp. camp" where the Spanish troop Pike followed had previously camped. Between Rule Creek and the Purgatoire was written: "Here we first discovered the mountains." Other notes indicated that the area west of Rule Creek was "rocky hills" and the Purgatoire River was "Deep & Rapid." Pike camped on the west bank of the Purgatoire, near its mouth.

It should be pointed out that Pike's expedition saw no native tribes in the vicinity of John Martin Reservoir, although there were some signs of Indian camps. Just west of the present location of Las Animas they did meet a Pawnee war party which was in search of their enemies, the Comanche. Pike's company proceeded up the Arkansas to its confluence with Fountain Creek where they "cut down 14 logs and put up a breast work, five feet high on three side" (Jackson 1966 vol. 1:349). This was near the modern city of Pueblo. Pike decided to try and climb the mountain he called "Grand Peak," which today bears his name. Wearing light clothing the group was ill prepared for the climb, and after failing to reach the top Pike recorded, "I believe no human being could have ascended to its pinnacle." Pike's party next wandered through South Park, and descended into the San Luis Valley where they built a crude "stockade or breast work" of cottonwood logs on the Conejos. There they were discovered on February 26, 1807 by a troop of Spanish soldiers. The Americans were taken into custody, escorted to Santa Fe and then to Mexico, before being released to return to the United States.

Zebulon Pike returned from this extraordinary mission only to find himself implicated in the Aaron Burr conspiracy. Pike's association with General James Wilkinson, who had ordered the expedition, was the basis for the suspicion surrounding his exploits, although some modern historians think there is not enough evidence to support Pike's involvement with Burr and Wilkinson's plans. As Donald Jackson (1966) has pointed out, Pike happened to enter the Spanish borderlands at a sensitive time, when the southwestern boundry of the Louisiana Purchase was still unclear. Pike, however, enjoyed his role as spy as much as he liked the role of explorer. The account of his expedition, published in 1810, included many details about Mexico, and was warmly received by the public. Historians, however, have focused upon Pike's comments about the environment of the plains,

which he compared to the Arabian desert. Pike's impact upon the public image of the plains is more fully discussed in Section 3.1.

The discrepancy over the southwestern border of the Louisiana Territory was settled in 1819 when a treaty between the United States and Spain designated the Arkansas River as the official permanent boundry. That same year the American government began arranging the so-called "Yellowstone Expedition." The original plan was to combine a military expedition up the Missouri River, to awe the natives and attempt to open a route to the Pacific Ocean, with a scientific exploration of the region around the Rocky Mountains. However, when the expedition bogged down along the Missouri River, Congress grew impatient with the adventure and greatly reduced its scope. The military component was sent to open a road between Camp Missouri and Fort Anthony. Meanwhile, the scientific group, under the command of Major Stephen H. Long, left Council Bluffs in June of 1820, and proceeded up the Platte River to the South Fork of the Platte in present day Colorado. Turning south the party followed the general line of Fountain Creek to the Arkansas River. Along the way Edwin James, the historian for the group, became the first American to successfully scale Pike's Peak.

The Long party traveled down the Arkansas River, and on July 21, 1820, near the mouth of Huerfano Creek, they encountered an Indian and his squaw on horseback which the French guide identified as Kaskaia or "Bad-heart". Modern scholars believe these to be Plains Apache (Hyde 1959; Wedel 1959). The natives told them that part of six tribes were gathered together about 19 days journey down the river. According to James, "These were the Kaskaias, Shiennes, Arrapahoes, Kiawas, the Bald-heads, and a few Shoshones or Snakes" (James in Thwaites 1905, vol.16:55). These tribes had just returned from a battle with the Spanish on the Red River.

Near the modern location of Rocky Ford it was decided to split the party up. Major Long took some men south to the Red River, while the rest were to continue down the Arkansas to Belle Point, under the direction of Captain John R. Bell. The Bell group reached the Purgatoire River on July 25, 1820. Bell noted that while Pike had named it "1st Fork," Bijeau the guide said that the Spanish called it, "Les ammes du purgatri, or Souls purgatory - because a number of Spaniards, having on a time been killed on this fork, whose souls have never been redeemed from hell by the Catholic priests, for some cause or other," an oblique reference to the Humana tragedy (Fuller and Hafen 1957:189). In his journal Bell described the sandstone bluffs above the Arkansas and the stands of cottonwoods on the river bottom in the general vicinity of the John Martin Reservoir. While traveling through the project area Bell's group met a small camp of Kiowa Indians. They were informed that a larger encampment of Indians were further down the river, under the leadership of the Arapahoe chief Bear's Tooth. The Long expedition was one of the first to note the presence of Arapahoe and Cheyenne on the Arkansas River. According to Bell, "The Cheyennes are a small band of the Cheyenne nation residing about the head of the Cheyenne river. This band, I understand, had some time since left their nation and attached themselves to the Arrapahoes" (Fuller and Hafen 1957:202).

After the Long party returned to the United States, Edwin James published his account of the journey. His opinions about the Great Plains echoed Pike, for he felt the region was "uninhabitable by people depending on agriculture." The Long expedition map of the area labeled the plains the "American Desert." It was many years before this notion was finally dispelled (Section 3.1).

7.1.2 TRAILS, TRAPPERS, AND TRADERS

It was the lure of the furs and trade which first brought Americans to the Arkansas River Valley. When Zebulon Pike was camped at the stockade on the Conejos in February, 1807, he wrote in his journal that as early as 1804 William Morrison, one of Manuel Lisa's partners in the Missouri Fur Company, had sent a creole named Baptiste La Lande to Santa Fe to trade with the Spanish. La Lande reached Santa Fe, sold the merchandise at a good price, and remained in New Mexico, keeping the profits for himself (Jackson 1966, vol.I:378). Pike also recorded the fact that when he was escorted through New Mexico by the Spanish authorities, he met a man named "Pursley," or James Purcell. A native of Kentucky, Purcell told Pike he had made his way to Santa Fe with two French traders who worked for Regis Loisel, arriving there in June, 1805 (Jackson 1966 vol.II:59).

Although the Spanish who controlled Santa Fe wished to keep it closed to foreigners, that did not deter American traders from attempting to reach the city. Most of these early attempts ended in disaster. In the fall of 1806 the St. Louis fur trader Jacques d'Eglise succeeded in reaching New Mexico, only to be murdered by two Spaniards near Santa Fe (Weber 1971).

One of the more famous American exploits in this area were the adventures of Ezekiel Williams. In 1811 Williams accompanied a party led by Jean Baptise Champlain for Manuel Lisa's Missouri Fur Company. They traveled as far as the Arkansas River, and remained there until the spring of 1812. Four members of the group went to Santa Fe while the rest continued to hunt in the mountains. Williams and Champlain were captured by the Arapahoe, but in March of 1813 Williams managed to escape, and traveled down the Arkansas to Missouri. In May, 1814 Williams joined up with Joseph Philibert, who was taking a party to hunt furs along the upper reaches of the Arkansas River. Williams was unable to locate his former companions, but he did recover the furs he had cached in the mountains the year before (Chittenden 1954:652).

Ezekial Williams took his furs back to the States, but Philibert's men remained on the Arkansas. Philibert himself returned to St. Louis, where he joined up with Auguste P. Chouteau and Jules De Munn, two well known merchants, and accompanied them westward. While the trappers established their base camp on the Arkansas River, De Munn attempted, unsuccessfully, to obtain a trading license from the Spanish authorities in Santa Fe. The Spanish viewed the American presence as a threat, and in May, 1817 the Chouteau-De Munn party was arrested, imprisoned for 48 days in Santa Fe, and had their goods confiscated (Weber 1971; Cleland 1950). They were luckier than the first trading expedition of Robert McKnight, James Baird, and Samuel Chambers, who reached Santa Fe in 1812 only to be incarcerated for nine years.

Not until Mexico had declared its independence from Spain were Americans able to successfully trade there. William Becknell is generally credited with being the first American to open the Santa Fe trade route in 1821. He returned from the trip with a handsome profit and the next year Becknell blazed a new trail to Santa Fe, using the Cimarron Cutoff across the desert. The other trail to Santa Fe, known as the "mountain route," followed the Arkansas River and then turned south over Raton Pass (Gregg 1967). This route went directly through the John Martin Reservoir Project Area, and although the trail can not be seen on the ground today, the evidence of wagon ruts can still be discerned in aerial photographs.

Becknell was not the only American trader to take advantage of Mexico's more lenient attitude towards international commerce. Thomas James, a St. Louis storekeeper, reached Santa Fe laden with textiles in December, 1821. That same year a fur hunting party, lead by Colonel Hugh Glenn of Cincinnati and Jacob Fowler, a surveyor from Kentucky, started from Fort Smith and "meandered the whole course of the Arkansaw" to the site of modern day Pueblo (Coues 1898). On November 12, 1821 the party reached the location of what is today the John Martin Reservoir and Fowler wrote in his journal (complete with misspellings):

> We this day Crossed a Small Crick (Caddoa Creek) at about four miles back from Camp – and pased over Several Ridges the points of Which Butted against the River With progecting Rocks of the Sand Stone kind – the(re) We Seen Some peaces of marble – the River Bottoms are about Half a mile Wide and is offen Crosed from one Side to the other by the River Which is very Cruked and both Sides of the bottom or valley bound With the Bluffs and Rocks Buffelow plenty killed 3 Cows and one deer this day – (Couse 1898:38).

At Rule Creek the Glenn-Fowler party got their first glimpse of the mountains. When they got to the Purgatoire River Fowler noted that, "there is on this forke a continuation of timber and Brush the princeple trees are cotton wood With Some Boxelders and Some Small Black locust." There the group encountered a grizzly bear which attacked and killed Lewis Dawson, one of the members of the party. They continued up the Arkansas, and near the present location of the city of La Junta they came upon a large encampment of natives. In the November 24, 1821 entry into his journal Fowler observed:

> A nomber of Cheifs of other nations arive In Camp – thing Ware a better appeearance – We sopose there Is now 350 lodges – Some little traid for Buffelow Roabs for the benefit of the Hands on our arivil at this Camp there was about forty lodges of Indeans – Kiawas and Padducas the continu to Increes and last night on Counting them over find now four Hundred of the following nations – Ietans (Comanches) – Arrapohoes – Kiawa Padduce (Kiowa Apache) – Cheans (Cheyennes) – Snakes – the Ietan the most numerous and the most Disperete the Arrapohoes the Best and most Sivvel to the White men habits (Coues 1898:54).

Just west of the Huerfano, the Glenn-Fowler party met a group of Spaniards and were told that New Mexico had opened its doors to foreign trade. So after building a temporary shelter near the modern city of Pueblo, the American trappers sent out for the Spanish settlements. Having bartered their goods in Taos, the Fowler party started back to the States, joining up with the Thomas James and Robert McKnight groups on the way.

The route along the Arkansas River thus became part of the famous Santa Fe Trail. It not only served as a major transportation artery, but as a source area for beaver and a center for the Indian trade. Early American trapping parties which hunted beaver on the upper Arkansas included Sylvester and James Pattie in 1826-1827 (Cleland 1950), and the Bean-Sinclair group of 1830 (Hafen 1954). As Fowler had noted in 1821, the Comanche, Kiowa, Kiowa Apache, Arapahoe, Cheyenne, and even the Shoshoni, visited the Arkansas River Valley. To accommodate trade with these tribes John Gantt was one of the first to erect a "temporary fort and trading post" on the Upper Arkansas in 1832. It was Gantt who is suspected of introducing liquor to the Cheyenne (Lecompte 1964). Other trappers and traders, including Robert Newell, Lancaster Lutpon, and Sarpy & Fraeb, also built temporary posts along the

Arkansas River (Lecompte 1978:33).

However, by far the most important trading post on the Arkansas was the adobe fort operated by the firm of Bent, St. Vrain & Company, located some 20 miles west of the project area, and known then as "Fort William" but today referred to as "Bent's Old Fort." Much has been written about this post, and the interested reader should consult Grinnell (1919), Hafen (1954), Lavender (1954), Lecompte (1964), Moore (1973), and Thompson (1979). There has been some debate about when Bent's Old Fort was built. Charles Bowman (1881), George Grinnell (1919), and Charles Hurd (1975) all mistakenly believed that the post was erected in 1828. Modern scholars (Hafen 1954, Lavender 1954; Lecompte 1964) have presented more convincing evidence that Bent's Old Fort was built in 1833-1834. The first fort built on the Arkansas River by the Bents was a simple picket post, on the north bank about eight miles below Fountain Creek. John Gantt, feeling the heat of competition, abandoned his original post, and constructed one of adobe, later known as "Fort Cass," near the Bents' picket post. The Bents were not happy to have a rival so near, and one incident was reported where William Bent led an attack upon a group of Shoshoni Indians who were camped next to Gantt's fort (Lecompte 1964). Having established their superiority, the Bents moved down the Arkansas near present-day La Junta and built the adobe post which became known as "Bent's Old Fort."

The firm of Bent, St. Vrain & Company, including the four Bent brothers, Charles, William, Robert, and George, in partnership with Ceran St. Vrain, dominated the region's Indian trade. Their empire stretched from Taos, where Charles Bent ran the operations, to the Arkansas where William Bent supervised trading activity, to the South Fork of the Platte River where Fort St. Vrain was erected. Bent's Old Fort was a successful operation because its location was ideally suited to take advantage of trade with several different tribes, as well as commerce along the Santa Fe Trail. The Bents could trade for buffalo robes with the Cheyenne, Arapaho, Kiowa, and Comanche, as well as taking in beaver pelts from Euro-American trappers. In 1840 William Bent convinced part of the Cheyenne nation to move permanently to the Arkansas, and he eventually strengthened his bond with these Indians by marrying into the tribe.

Because it was one of the major trading establishments of the fur frontier, Bent's Old Fort captured the attention of many who visited it. As a result, historians are left with a wealth of contemporary accounts. In 1835 Colonel Henry Dodge held council with the Cheyenne and Arapahoe at Bent's Old Fort (Dodge 1836; Pelzer 1926). The post was also described in some detail in 1839 by various members of the so-called "Peoria Party," a group attempting to emigrate to the Oregon Territory (Farnham 1843; Hafen 1955). Other well known accounts include the descriptions left by Lewis Garrard (1955) who was there in 1845, and Francis Parkman and Susan Shelby Margoffin who saw it in 1846.

This outpost played a major role in America's expansion westward. In 1845 Stephen Watts Kearny, leading a company of dragoons on a survey of the Oregon Trail, stopped by Bent's Old Fort on his way back to the States. A few days later John C. Fremont arrived at the fort, having followed the Santa Fe Trail westward on his Third Expedition. A year later Kearny used Bent's Old Fort as a depot for his Army of the West before proceeding to Santa Fe during the Mexican-American War. Charles Bent was rewarded for his contributions to the war effort when Kearny appointed him the first American Governor of New Mexico. Unfortunately, Charles Bent later lost his life during a short lived revolt in Taos in 1847. The treaty of Guadalupe Hildalgo in 1848 officially ended the Mexican War and

gave the United States control over a large part of the southwest, including the region south of the Arkansas River.

Around 1849 William Bent and Ceran St. Vrain dissolved their partnership. Bent attempted to sell his fort to the United States, but when the price they offered did not meet his expectations he loaded up his wagons with goods and abandoned the place. It is still debated whether or not Bent blew up the old fort, or fumigated it with burning barrels of oil against cholera when he left. In any case the post was later utilized as a stage stop for the Barlow and Sanderson Stage Line, and as a ranch house and corral, before it finally fell into ruins (Arps 1979).

William Bent then moved down the Arkansas River to Big Timbers, about ten miles east of the John Martin Reservoir Project Area, where he continued to trade with the Indians and ran a freighting business. During the winter of 1852-1853 he set men to work building a new stone trading post, known as "New Bent's Fort" (Lavender 1954:346).

Since the days of Old Bent's Fort the United States government had toyed with the idea of establishing a military outpost on the Upper Arkansas River to protect travellers along the mountain route of the Santa Fe Trail. Finally, on June 30, 1860 the War Department issued General Orders No. 8 which called for the construction of a military fort at Big Timbers. At that time the Upper Arkansas Indian Agency was already located at Bent's New Fort, with William Bent as the Indian Agent. This made it the logical choice for the location of the new military base. The government began to negotiate for the purchase of Bent's New Fort, but only the rental of space for storage was agreed upon. Major John Sedgwick was to command the new post, known as Fort Wise, named after Henry A. Wise, the governor of Virginia. Sedgwick arrived from Fort Larned, Kansas, with companies of the 1st U.S. Cavalry and the 10th Infantry, in early September 1860, and selected a site for the new fort on a tract of bottom land on the north side of the Arkansas River, about half a mile from Bent's New Fort. When the Civil War broke out it was decided that the name of the post should be changed, and on June 5, 1862 Brigadier General Blunt at Fort Leavenworth ordered that it be called Fort Lyon, after Brigadier General Nathaniel Lyon, the first Union general to be killed in the war (Taylor 1969; National Archives, Returns From U.S. Military Posts, Fort Lyon).

William Bent resigned his position as Indian Agent and in 1859 he abandoned his stone fort for good, and took his cattle and wagons and moved up the Arkansas River to the bottomlands around the mouth of the Purgatoire River, where he built a stockage and ranch. This ranch was later operated by his son-in-law, R. M. Moore (Bowman 1881). Here William Bent passed away in 1869.

Bent was not the only person to attempt to settle down and farm or ranch along the Arkansas River. Some former trappers and Mexicans built a small village known variously as "El Pueblo," "Fort Leche," or the "Milk Fort" because its inhabitants drank goats milk. This hollow square of adobe enclosed a compound of about thirty rooms and was described in 1839 by such visitors as Thomas Farnham and F. A. Wislizenus. The people there made a meager living hunting, trading, raising livestock, and growing a little corn. By 1841, however, the post had been abandoned (Lecompte 1978:18). In 1842, a group of Americans built an adobe settlement on the Arkansas River, near Fountain Creek, known as "Fort Pueblo." This trading post was wiped out by an Indian attack in December 1854. A settlement known as San Buevaventura de los Tres Arrollos was founded in March, 1844 on the Hardscrable River, but the town soon took the name of the river. Hardscrable was basically a farming community, with a little

trade conducted on the side. Like the other early settlements of the Arkansas River Valley, it did not survive.

In January of 1844 William Bent's partner, Ceran St. Vrain, and Cornelio Vigil were official recipients of a huge land grant from the Mexican government, known as the Las Animas Grant, which encompassed the valleys of the Huerfano, Apishapa, Cucharas, and Purgatoire rivers. In 1860 the United States confirmed the Vigil and St. Vrain Grant, but reduced its size to twenty-two square leagues (Bradfute 1970). One of the original conditions of the grant made it necessary to establish settlements there. So in 1853 St. Vrain persuaded Charles Autobees, an old mountain man from Missouri, to found a settlement on the Huerfano. Although the settlement was not successful, Autobees lived at his ranch there until his death. Another transient village within the boundries of the Las Animas Grant was the one that sprung up around John Brown's store on the Greenhorn River. Indian raids led to the eventual abandonment of this settlement by 1853 (Lecompte 1978). These first attempts to establish agricultural communities on the upper Arkansas River ended in failure, but they foreshadowed events to come.

7.1.3 REMOVAL OF THE NATIVE AMERICANS

In the 1840s when the first wagons began to move across the overland trails to the west coast the Great Plains were still occupied by native tribes. The usual route to Oregon and California followed the Platte River and then over South Pass in Wyoming. However, a substantial number of immigrants also used the Santa Fe Trail (Unruh 19~~79~~76:400). The government of the United States was concerned about protecting the people who traveled along these trails, so in 1851 Thomas Fitzpatrick, the former mountain man who was then Indian Agent for the Platte and Arkansas agency, called a meeting at Fort Laramie of the tribes who inhabited the northern plains. The result of the Treaty of Fort Laramie was that tribes agreed upon some definite boundries and promised not to molest travelers on the overland trails. Specifically, the Cheyenne and Arapahoe were assigned the area between the Platte and Arkansas River. In 1853 Fitzpatrick arranged a similar council with the Kiowas and Comanches at Fort Atkinson, and these tribes agreed to occupy the region south of the Arkansas River.

The temporary peace was shattered by the Pikes Peak gold rush of 1858-1859. Miners coming to the area used either the Santa Fe Trail along the Arkansas River, the route along the Platte River, or the Smokey Hill Trail across the plains between the Smokey Hill River and Cherry Creek (Billington 1956: 26). Conflicts quickly arose between the gold seekers and the natives. The Indians saw their land taken from them and their game driven off. In the fall of 1860 federal agents began negotiating with the Cheyenne and Arapahoe. These tribes agreed, in the so-called Fort Wise Treaty of 1861, to give up their traditional hunting land between the Platte and Arkansas River in return for a small triangular reservation between the Arkansas and Sand Creek and a government subsidy. Not all was well on the reservation. The Indian agent for the Cheyenne, Samuel Colley and his son, made a small personal fortune by selling goods which should have been distributed to the natives. Unhappy with the reservation, some of the younger braves went out on raids against the whites. In one grisly affair a settler named Ward Hungate, his wife and two children, were killed just twenty miles outside of Denver. Their bodies were brought to town and displayed, prompting residents of the territory to demand that something be done about the situation.

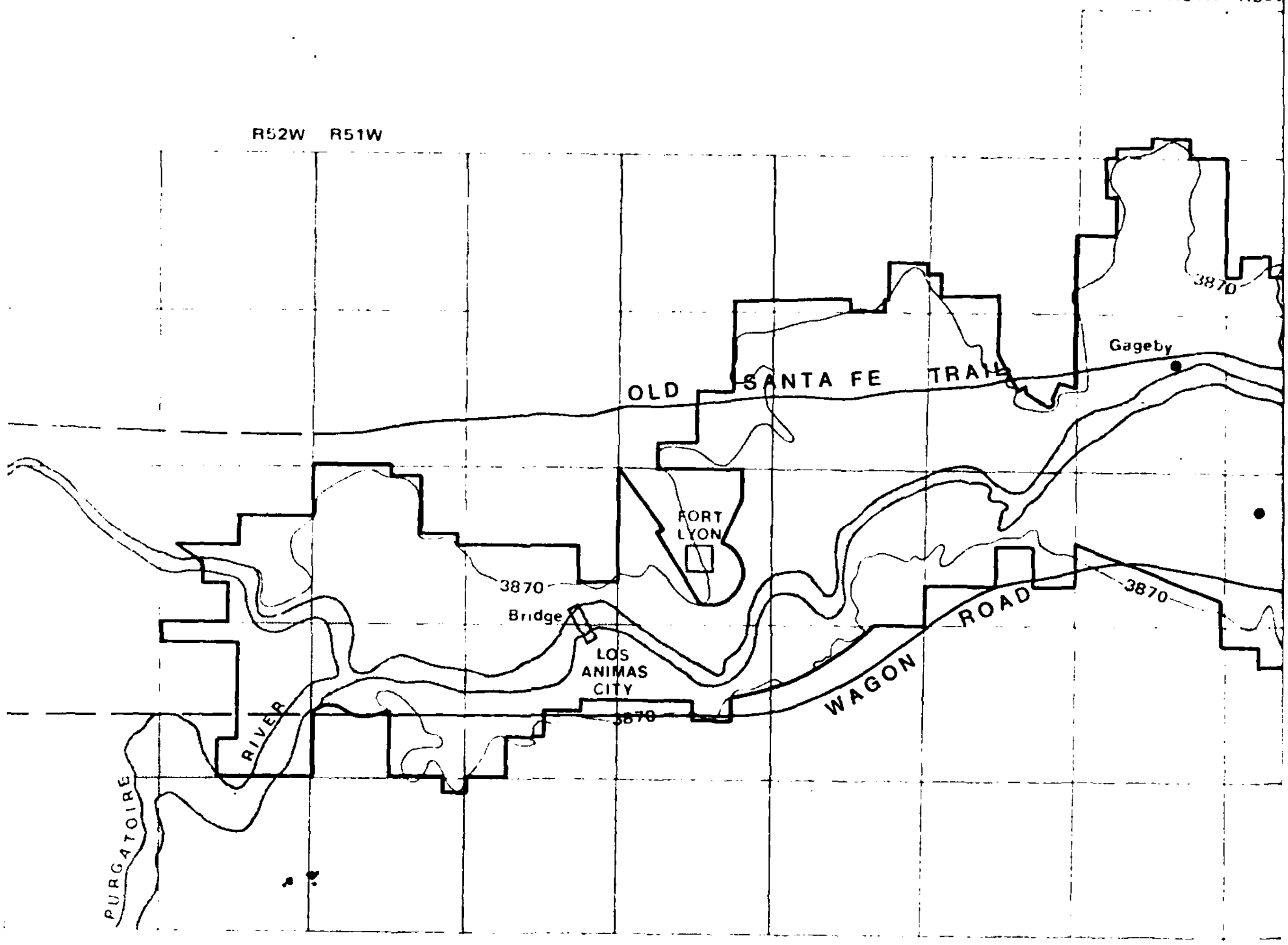
John Evans, the Governor of the Colorado Territory, responded by asking all the Plain tribes to gather at various forts. Under the urging of William Bent, Black Kettle, a Cheyenne

chief, wrote a letter to Major E. W. Wynkoop, Commanding Officer at Fort Lyon suggesting a peaceful settlement. Wynkoop took it upon himself to escort representatives of the Cheyenne and Arapahoe tribes to Camp Weld to meet with Governor Evans and Colonel John M. Chivington, Commander of the 34d Regiment of Colorado Volunteers. The Indians were told to lay down their arms, and the chiefs interpreted that to mean they could go back to the reservation in peace. Under the eye of Major Wynkoop the Indians gathered at Fort Lyon. When Wynkoop was replaced by Major Scott J. Anthony the Indians were ordered away from the fort, and in November, 1864 they set up camp on Sand Creek, believing that they were under the protection of the Federal government. On November 28, 1864 Colonel Chivington arrived at Fort Lyon with his troops. Hoping to make a name for himself as an Indian fighter Chivington sent his men to attack the Indian camp. The result was the so-called "Sand Creek Massacre" in which the army fell upon the unsuspecting Indians, killing mainly women and children (Hoig 1961).

Stirred to revenge, the survivors of the incident joined with other tribes and led attacks against Euro-American settlers, including the sacking of Julesburg in northeast Colorado in January, 1865 (Hyde 1959). In October of 1865 several of the Cheyenne bands agreed to sign a treaty on the Little Arkansas negotiated by William Bent and Kit Carson. This treaty established a new reservation for the Cheyenne and Arapahoe around the confluence of the Cimarron and Arkansas River. One half section was granted to each signator on the reservation, and 160 acres of land was assigned to survivors of Sand Creek who lost a relative in the massacre. Thirty-one individuals with mixed blood were assigned a section of land within the old Fort Wise Treaty reservation area (Berthong 1963:243). These claims became known as "Indian Claims" or "Beef-Steak Claims" because of their irregular shape. Usually these claims included choice hay bottoms along the Arkansas River. Indian Claims No. 17, 18, and 19 were located on the north bank, within what is now the John Martin Reservoir Project Area (See Figure 7.1).

The Treaty of the Little Arkansas did not end the hostilities. Bands of war-like Indians continued to roam the plains. The returns from Fort Lyon for this period indicate that there was limited native activity in the region around the project area. The record of events for February 1866 read, "No Indian depredations committed in this section of the country within the past month." In January 1867 there was the report that troops had been sent out in search of "hostiles" but could not find them. On May 25, 1867 an attack was made on the stage station at "Pretty Encampment" where one man was killed and some stock was driven off (National Archives). In spite of the Treaty of Medicine Lodge Creek of October, 1867, where the Cheyenne and Arapahoes agreed to peace, allowed stage lines and railroads through their hunting grounds, gave up any land claims in Kansas, and accepted a smaller reservation between the Arkansas and Cimarron River, incidents between small war parties and settlers were reported. On the eve of the first election held in Bent County, on September 7, 1868, Thomas Kimsey, the election judge, was killed by Indians on his way between the Sizer ranch and Boggsville (Hurd 1975: 17). The Cheyenne continued on to Boggsville and killed some cattle and ran off horses and mules belonging to Thomas Boggs, Robert Bent, Kit Carson, L.A. Allen, and John W. Prowers. The raid was reported to the commanding officer at Fort Lyon, and General Penrose sent out a troop of the 7th Cavalry and some infantry under the direction of Captain Berry, with L. A. Allen as the guide. They caught a small group of Indians on Rule Creek and a brief battle was fought, which left 2 soldiers dead, 1 wounded, while the Cheyenne lost a noted

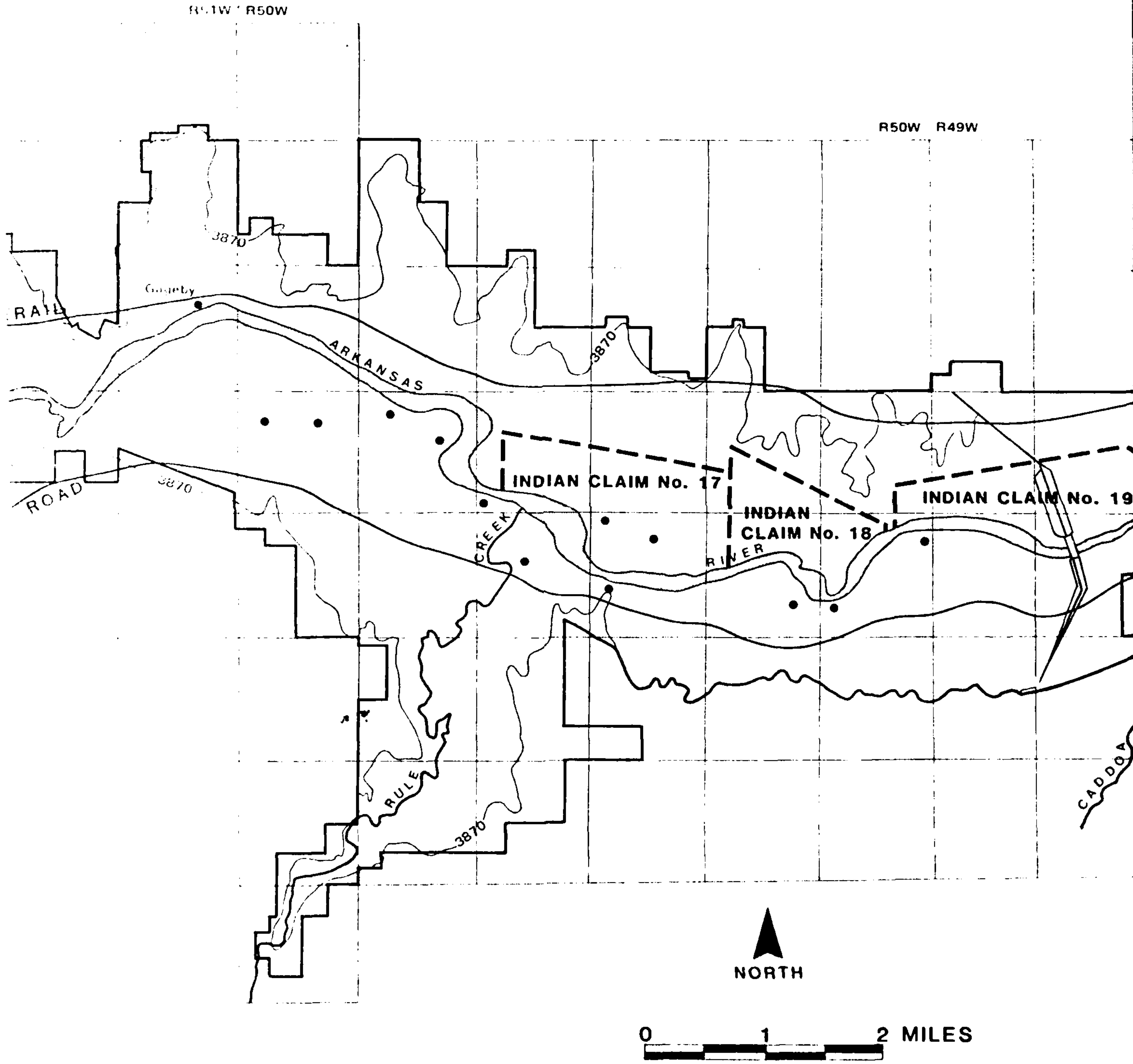
FIGUR
1871 S
JOHN MARTIN RES

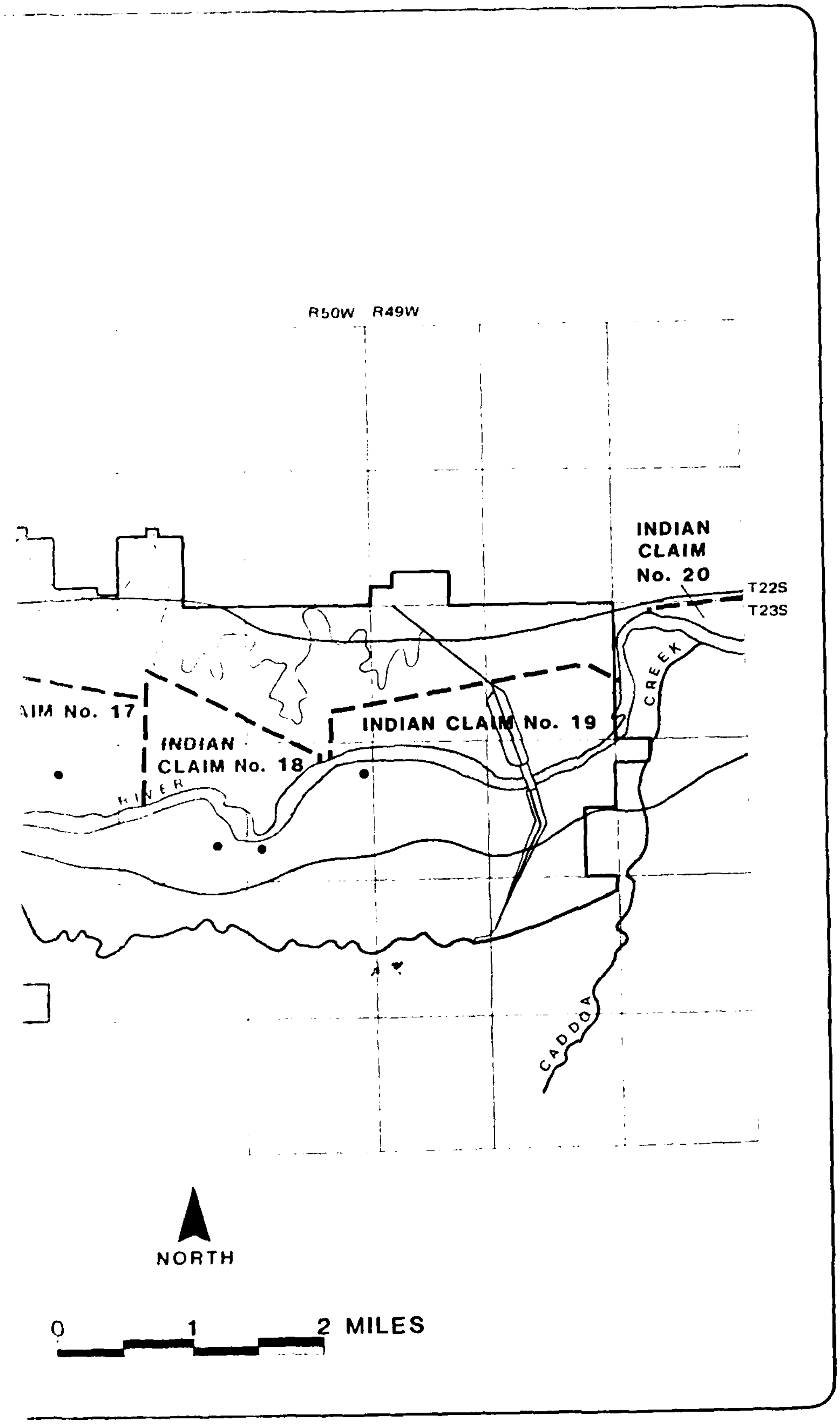


Study Area Boundary
Top of Flood Control Pool 3870
Ranches

Source: George Hill 1871 Survey of Bent County, Bureau of Land Management, Colorado State Office, Denver

FIGURE 7.1
1871 SURVEY
JOHN MARTIN RESERVOIR PROJECT




R50W R49W
INDIAN CLAIM No. 20
T22S
T23S
CREEK
AIM No. 17
INDIAN CLAIM No. 18
INDIAN CLAIM No. 19
RIVER
CADDOA
NORTH
0 1 2 MILES

warrior, One Eyed Bull (Berthong 1963:307; Cahill 1923:5).

In response to these raids, General Philip Sheridan ordered Major George A. Forsyth to lead a small detachment from Fort Hays against the hostiles. A group of Cheyenne and Sioux surprised the soldiers, who were forced to take refuge on an island in the Arikaree River, where they lay under siege for nine days before being rescued by a relief column of the 10th cavalry (Andrist 1964:153). This incident was later called the Battle of Beecher Island, after a young Lieutenant who died there. The Cheyenne lost their respected warrior, Roman Nose, in the fight. Soon after, a party of Cheyenne, Arapahoe, and Kiowa attacked a wagon train near Sand Creek, stampeding the oxen, wounding one man, and seizing Mrs. Clara Blinn and her small child, before troops from Fort Lyon arrived. To punish the Indians for these depradations, General Sheridan planned a military campaign for the winter of 1868-1869. Major Andrew Evans was ordered to march down the Canadian with troops from Fort Bascom, New Mexico. George Custer commanded the 7th Cavalry out of Fort Dodge. Major Eugene A. Carr and William Penrose led troops from Fort Lyon to Upper Beaver and Wolf Creek, with William F. (Buffalo) Cody, as guide. The Fort Lyon detachment suffered through a blizzard on the Oklahoma Panhandle, and were forced to return to their base without engaging the Indians (Boyd 1967; Cahill 1923). Custer, however, attacked Black Kettle's camp on the Washita. The repurcusions of Custer's campaign was that the Cheyenne and Arapahoe were subdued and relocated on a reservation in Oklahoma (Berthong 1963).

7.1.4 EURO-AMERICAN SETTLEMENT

Several factors influenced the planting of permanent Euro-American communities along the banks of the Arkansas River. The major impediments to settlement had been the Indian menace and the Civil War. By 1869 most of the natives had been removed from the area and the war was long over. The real impetus for town building, however, was the arrival of the railroads in the 1870s.

In the fall of 1859 some of those who were headed for the gold fields along Cherry Creek settled at the mouth of Fountain Creek, near where the old "Fort Pueblo" site had stood only five years before. Calling their village "Fountain City" these settlers discovered that the miners provided a convenient market for their agricultural goods. The town thrived, changed its name to Pueblo, and by 1870 had 1,000 residents (Van Hook 1933).

The first permanent Euro-American settlers in the region around the project area were people who had been associated with the Indian trade. In 1859 William Bent had built a ranch near the mouth of the Purgatoire River. Others, who had been associated with Bent, soon settled near him. John Wesley Prowers first came to the Arkansas Valley in 1856 from Missouri to assist Robert Miller, the Indian Agent at Bent's New Fort. He then went to work for William Bent, running the freight operation out of the fort. In 1861 he married Amanche, daughter of Ochinee, a Cheyenne chief. That same year Prowers introduced the first permanent herd of cattle to the area, grazing them between the Purgatoire and Caddoa Creek (Bowman 1881).

There has been some confusion in the historical documents about the history of the site of the town of Caddoa. In 1862 the U.S. government built three stone buildings near the mouth of Caddoa Creek for use of a group of Caddo Indians displaced from Texas by the Civil War. The Indians did not like this location, and settled instead on the Canadian River. In 1863 Prowers purchased the three stone buildings and used it as the headquarters for his cattle ranch (Bowman 1881; Hudnal 1945; Hurd 1938).

The Prowers ranch was called Caddoa, but it is not the same location as the town with that name. The 1871 survey of Bent County by George Hill showed the Caddoa ranch buildings were located on the south side of the Arkansas River in the SE 1/4 of Section 3, T.23S, R.49W, which is outside of the John Martin Project Area, located just east of the dam, near the mouth of Caddoa Creek. The town of Caddoa was not established until 1887, on the south side of the Arkansas River, in Section 12, T.23S., R.50W.

In the fall of 1863 Thomas Rule and his family attempted to settle along Rule Creek. They built a small stone house there, but the threat of Indian depradations forced them to leave. More successful were the efforts of people like Urial Higbee, Samuel T. Smith, William Richards, Bob Jones, John Carson, and Jim Elkins who settled in the fertile Nine Mile Bottoms region of the Purgatoire River around 1865 and engaged in farming and ranching (Bowman 1881).

In 1860 Thomas O. Boggs acquired 2,040 of the Vigil and St. Vrain Grant along the Purgatoire River. Boggs used the land as a summer grazing area for his herd of cattle and sheep. In 1866, accompanied by L. A. Allen and Charles L. Rite, Boggs settled permanently on the Purgatoire, about three miles above its junction with the Arkansas, building a large adobe house and founding the town of Boggsville. This was the first permanent community in Bent County. In 1867 Kit Carson, the famous frontiersman, made Boggsville his home and entered into the sheep ranching business with Thomas Boggs. John W. Prowers moved there in 1868 and built a fourteen room adobe house (Hurd 1975; Hudnall 1945). After the formation of Bent County, the first local election of 1870 made Boggsville the county seat. It prospered for a short time as an agricultural village, supplying Fort Lyon with meat and vegetables. When the railroad was completed to West Las Animas in 1873, however, Boggsville was doomed. By 1880 it was no longer even listed in the U.S. census (Van Hook 1933:401).

One of the contributing factors aiding the permanent settlement of the lower Arkansas River Valley in Colorado was the stability provided by the presence of a U.S. military post. In 1860 Fort Wise, later renamed Fort Lyon, was established near Bent's New Fort, on the north bank of the Arkansas River at Big Timbers. In the spring of 1866 the Arkansas River flooded and undermined the foundations of Fort Lyon. The troops were forced to evacuate the post and take refuge in tents on the adjoining bluffs. The fort's Quartermaster, Captain Kirk, then proceeded 25 miles westward and located the new site for Fort Lyon. The Post Returns for Fort Lyon indicate that the old site was abandoned and the troops were transfered to New Fort Lyon in June 1867 (Bowman 1881; Boyd 1967; National Archives).

The establishment of New Fort Lyon served as the impetus for the creation of a town directly across the Arkansas River from it, called Las Animas City, but later known as Old Las Animas. In 1869 William Craig, who had obtained possession of a large portion of the Vigil and Las Animas Grant while Quartermaster of Fort Union, New Mexico, formed the Las Animas Town Company, and had the site surveyed and platted. A toll bridge was built connecting the town with the fort, and a ditch was dug to bring water from the Purgatoire (*Colorado Chieftan* 28 January 1869). By 1870 the place had a store, a livery stable, a restaurant, and three saloons (Bowman 1881). The town operated as a trade center for troops stationed at the fort and for the surrounding rural countryside. A. E. Reynolds, the sutler at Fort Lyon, had a dry good store in Las Animas City. So did R. M. McMurray, a former officer from the fort. The town also served as an important transportation nexus. The Barlow and Sanderson Southern

Overland Mail and Express Company used Old Las Animas as a major stage stop on its line between Kit Carson and Santa Fe. John W. Prowers, and his brother-in-law, John S. Hough, operated a commission house and transfer company in town. The expectation that Las Animas City would be the terminus for both the Kansas Pacific Railroad, building southwest from Kit Carson, and the Santa Fe Railroad, extending up the Arkansas Valley from Granada, attracted speculators, as well as real settlers to Old Las Animas (Van Hook 1933:403). The town enjoyed a brief boom, and by the spring of 1873 it boasted 700 inhabitants (*Las Animas Leader* 27 June 1873).

In 1870, when Bent County was first organized, Las Animas City was designated the temporary county seat. Later that same year a local election moved the seat of government to Boggsville. Then in 1872 Old Las Animas was again made the county seat. Visitors marveled at its rapid development. One wrote of:

> ...Main Street blazing with all sorts of signs in all kinds of shapes. Dry goods and grocery outfits, furniture establishments, cigars & tobacco, feed stables, drug stores, doctors and dentists, billiard halls, saloons, Long Shong (washer & ironer), barber shops, lumber yards, blacksmith shops, restaurants, millinery and dress making outfits — 13 variety stores on Main Street (*Las Animas Leader* 6 June 1873).

Reflecting the influences of New Mexico, many of the buildings in Old Las Animas were of adobe, some of stone, and a few were wooden frames on stone foundations. As Las Animas City grew, it quickly acquired a reputation as a wide open frontier town. One former resident recalled that with the saloons, "Many women of the red light order arrived. The sound of the deadly forty-five was often heard in the still hours of the night..." (Cahill 1923:36). Another visitor commented that, "Las Animas is a fast town. It has two dance houses, one American, and the other Mexican. Population mixed, both as to nationality and morals" (*Las Animas Leader* 23 May 1873). The manuscript U.S. population census sheets for the "Village of Las Animas" in 1880 indicated that most of the residents of the town were native-born Americans from the East and Midwest. About 9% of the population was Black, and their presence was no doubt related to the fact that Black cavalry troops were stationed at Fort Lyon. Only two Hispanics were listed on the census, both single men from New Mexico who worked as sheepherders. The only significant foreign-born group living in Old Las Animas were the Irish, who made up 18% of the adult population. Their residence in town was probably related to railroad construction or military service at Fort Lyon. A more detailed analysis of the population of this town can be found in Section 9.0.

Unfortunately, uncertainty over the title to the land, and the greedy speculation of outside investors, cost Old Las Animas the rail connections it had counted on and doomed it for extinction. William Craig had claimed ownership of the townsite through title derived from the Vigil and St. Vrain Grant. In 1869 Congress had amended its confirmation of the grant, ordering a new survey and stating that all derivative claims must be settled and have their boundries adjusted to the new survey. The public land not belonging to those who had derived titles from the heirs of the grantors, or squatters who had established their rights to the land, would then be open for public entry by preemption or homesteading (Bradfute 1970). Many of those who came to Las Animas City had chosen to squat on land outside the townsite rather than purchase lots from the Las Animas Town Company. In 1873, when it appeared that Las Animas would be the terminus of the Kansas Pacific Railroad, the discrepancies over title had

to be settled. A compromise was arranged whereby William Craig withdrew his claim to the townsite, and allowed it to be patented by Probate Judge Asahel Russell, "in trust for the several uses and benefits of the occupates of the Townsite of Las Animas City" (Bent County, *U.S. Receiver's Receipt & Patent Book* 25:283). In return the title of all parties who purchased lots from the town company would be recognized (*Colorado Chieftan* 19 June 1873).

The townspeople of Las Animas City had pinned their hopes on becoming a regional railroad center. In 1873 Bent County voted on a bond issue to contribute to the construction of the Kansas Pacific Railroad, building from Kit Carson to Pueblo. However, they did not count on the active opposition of the Atchison, Topeka, and Santa Fe Railroad, which also wished to build a road through the Arkansas River Valley. During the election the Santa Fe brought in several hundred men from Kansas to stuff the ballot boxes and defeat the bond issue for the Kansas Pacific (Cahill 1923:39). The defeat of the bond issue spelled the end for Old Las Animas, for the backers of the Kansas Pacific then decided to create their own townsite, on the west side of the Purgatoire River, five miles from the old town, and make the new site the railhead. The new town, called West Las Animas, was a joint venture between David H. Moffat of the Denver & Rio Grande Railroad and Robert E. Carr of the Kansas Pacific. They acquired the site under rather unusual circumstances, which the residents of Old Las Animas called a "land grab." Before February 25, 1873 any person attempting to file a claim on that land at the Pueblo Land Office were told that it had been registered as a derivative claim of the Vigil and St. Vrain Grant by one D. W. Hughes. When Hughes relinquished his claim, the land was preempted by a group of persons who then sold out to Moffat and Carr. The citizens of Las Animas filed a petition claiming that the warranty deeds bore the names of fictitious people, who had never homesteaded that land. Although there was a federal investigation, and the case eventually went to the Supreme Court, the town of West Las Animas was established, and in October, 1873 it received the railhead for the Kansas Pacific (Bradfute 1970; Van Hook 1933).

The Panic of 1873 slowed railroad construction, but in 1875 the Santa Fe Railroad also built to West Las Animas. Old Las Animas could not hope to compete with its new neighbor, with its two rail connections. Many of the businesses in the old town moved to the new one. In 1880 Old Las Animas had a population of only 103 people (U.S. Census). In 1883 the *Colorado Business Directory* listed only Charles Bobenreith, a grocer, and D. J. Linsey, postmaster and railroad agent, as the only businesses still left in town. By 1887 Old Las Animas was no longer listed in the Directory. In 1885 West Las Animas became the new county seat. Two years later it was incorporated, and with the old town virtually abandoned, West Las Animas dropped the "West" from its name and became the present town of Las Animas.

In spite of the arrival of the railroads to the Arkansas River Valley, the area was settled slowlv. With the exceptions of the claims derived from the Vigil and St. Vrain Grant, no homesteads were filed within the project area until after 1870. The 1871 survey of Bent County by George Hill showed just 13 ranches within the project area, 12 of which were located on the south bank of the Arkansas River in T.23S, R50W. Only the Gageby ranch was situated on the north bank for the river. During the entire decade of the 1870s only 46 homestead claims were filed within the Townships and Ranges which include the project area, and 40 of them were on the south side of the Arkansas (Van Hook 1933:145). This was mainly because the open range ranching industry had taken over control of the public domain. It appears that the southern side of the Arkansas was preferred for

grazing purposes.

7.1.5 THE OPEN RANGE CATTLE INDUSTRY

A few cattle were known to have been run along the Arkansas during the Spanish period and the early days of the fur traders. But not until the gold rush of 1858-1859 did the cattle industry in southeast Colorado get a real start. It began with the so-called "Texas Invasion," Texas cattlemen driving their herds north through Colorado on the way to market. In 1859 John C. Dawson drove the first herd of Texas cattle into the Colorado Territory. The Dawson Trail led from Oklahoma into Kansas, along Walnut Creek to the Arkansas River, up the north side of the Arkansas to Pueblo, and then up Fountain Creek to Denver. Also in 1859 Charles Goodnight drove his cattle from Texas to Colorado to be sold. Not until the mid-1860s, however, were cattle driven into Colorado in any great numbers. In 1865 Goodnight and Oliver Loving took a herd from Texas along the so-called Goodnight-Loving Trail into Colorado. These "long drives" from Texas continued through the 1880s. With the extension of the railroads westward, and the closing of Kansas to Texas cattle due to quarantine laws, the number of cattle being driven through Colorado increased. From June 9-20, 1886, 57 herds totaling 126,951 head were counted crossing the Arkansas River at Trail City in Bent County (Peake 1937:21).

The first permanent local herd of cattle was brought to Bent County from Missouri in 1861 by John W. Prowers. Eventually, Prowers became a powerful "Cattle Baron" in the area, controlling a huge tract of land. He began his empire by buying up several of the "beef-stake claims" granted to part blood Indian relatives by the Little Arkansas Treaty of 1865. He already owned the claims of his wife and mother-in-law, who were members of the Cheyenne tribe. In 1872 Prowers bought the 650-acre tract owned by Julia Bent, a daughter of William Bent by a Cheyenne wife, which included the remains of Old Bent's Fort (Arps 1979). By 1881 Prowers controlled 40 miles of range land along the Arkansas River. His 10,000 head roamed a range containing 400,000 acres, some 80,000 of which were illegally fenced as a single parcel.

Another cattle baron on the Arkansas was James C. Jones. The Jones brothers had first arrived at Nine Mile Bottom in December, 1869 from Texas. Jones preempted the use of the southern side of the Arkansas River as a range for his cattle. Although he owned only 8,000 acres, by controlling the water privileges his 15,000 head bearing the "J. J." brand could roam over nearly a million acres of public domain, stretching 50 miles long and 30 miles wide (Fritz 1941).

Bent County had one of the earliest cattle associations in the state. First formed in 1870, and reorganized in 1874, the Bent County Stock Association offered many services to its members. In fact, it was almost obligatory for cattlemen in the area to belong to it. The association hired detectives to capture rustlers, sold maverick cattle, hired health inspectors, attempted to prevent overcrowding on the range, outlined round-up districts, offered a bounty on wolves, and backed pro-livestock legislation at the state level (Peake 1937:103).

The early 1880s was the peak of the range cattle industry in Bent County. Large cattle companies were created, some backed by foreign capital. The Jones ranch was sold in 1881 to a Scottish concern, the Prairie Cattle Company. In 1883 the Prairie Cattle Company controlled 2,240,000 acres in Colorado, located east and south of the Purgatoire and Arkansas Rivers and extending to the Cimarron, on which they pastured 58,982 head of cattle valued at $1,705,000 (Peake 1937:58). Other divisions of this company held land in Texas, New Mexico, and

Oklahoma.

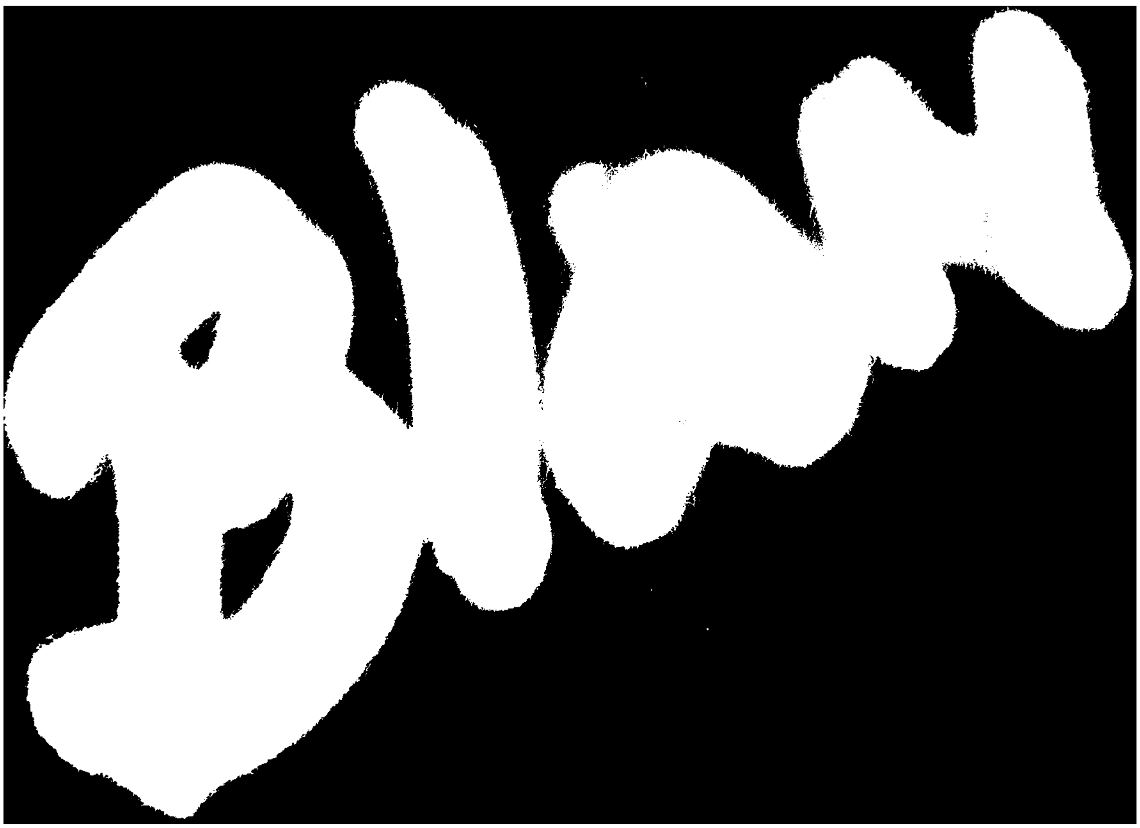
Several factors contributed to the decline of the range cattle industry and its replacement by stock farming and intensive agriculture in the late 1880s. First was the removal of illegal fences on public land. The fencing activities of the cattle barons were protested in Washington by homesteaders and others who wanted access to the public domain. A House of Representatives investigation showed that the Arkansas Valley Cattle Company and the Prairie Cattle Company each had over a million acres fenced. Bent County included some of the worst offenders. The result was that in 1885 President Grover Cleveland ordered all illegal fences removed, much to the ire of the cattlemen and delight of the homesteaders. The long drives from Texas were inhibited by the quarantine law of 1885, and by the end of the decade most Texas cattle were confined to the Old National Trail. Other factors leading to the end of the open range included the construction of irrigation ditches, the overstocking of the range, and several harsh winters in the mid-1880s. By the 1890s most livestock were confined to small fenced farms.

7.1.6 HOMESTEADING, IRRIGATION, AND FLOOD CONTROL

Long time residents of the area remember that during the 1870s virtually all ranches were located on the south side of the Arkansas River. The north side of the river was not settled until major irrigation projects were built. For example, by 1888 the Fort Lyon Canal was extended as far as Gageby (near the project area), and local records show that during the 1880s there were 151 homesteads or preemption claims filed within the Townships and Ranges containing the John Martin Reservoir Project Area. Eighty percent of this tracts were taken up on the north side of the river. In the 1890s there was a slight decline in the number of homesteads, as only 71 were filed within the area containing the project area. But again, 83% of these claims were on the north side of the Arkansas (Van Hook 1933; CWA files). A number of factors contributed to the increase in homesteading activity around the project area in the 1880s, including the decline of the open range cattle industry and expansion of stock farming; the extension of major irrigation projects putting more land under cultivation; a small land boom associated with the establishment of a local federal land office in Lamar; speculation surrounding the construction of additional railroad facilities; and higher than average rainfall during this period which encouraged the expansion of dry farming activities in eastern Colorado.

Using the sites located during the cultural resources survey of the John Martin Reservoir as a sample it is possible to look more closely at homesteading patterns in the project area. There appears to have been two small boom periods in the settlement of the project area. The first occured in the 1880s, when 11 sites, or 35% of all sites were patented. The second period of settlement was between 1910 and 1920, when 9 sites, or 29% of the total were patented. The earliest date of patent for any site in the project area was 1878, and the latest was 1923. The mean date of patent for all sites was 1902.

Again, using the sites recorded during the John Martin Survey it is possible to establish some generalizations about settlement patterns in the project area. Most ranches or farms started small and grew over time. In 1890 the average land holding was only 196 acres. By 1930 the average tract of land had increased to 1,365 acres in size. This meant that land was being concentrated into the hands of fewer people over time, as some could not make it and abandoned their parcels, while more successful operators increased their land holdings. This trend in increasing acreage of the average tract is found



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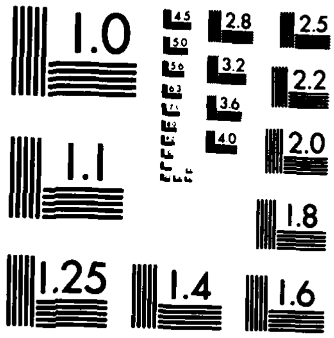
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throughout the Great Plains, and was due to the economic necessity of operating a larger unit to make a profit in this semiarid region, and to the mechanization of farm equipment (see Hargeaves 1957). Most of the land in the project area was locally owned, and this was a surprisingly stable region, with families controlling the same tract of land for significant periods of time and selling infrequently. A more detailed examination of these trends can be found in Section 9.0.

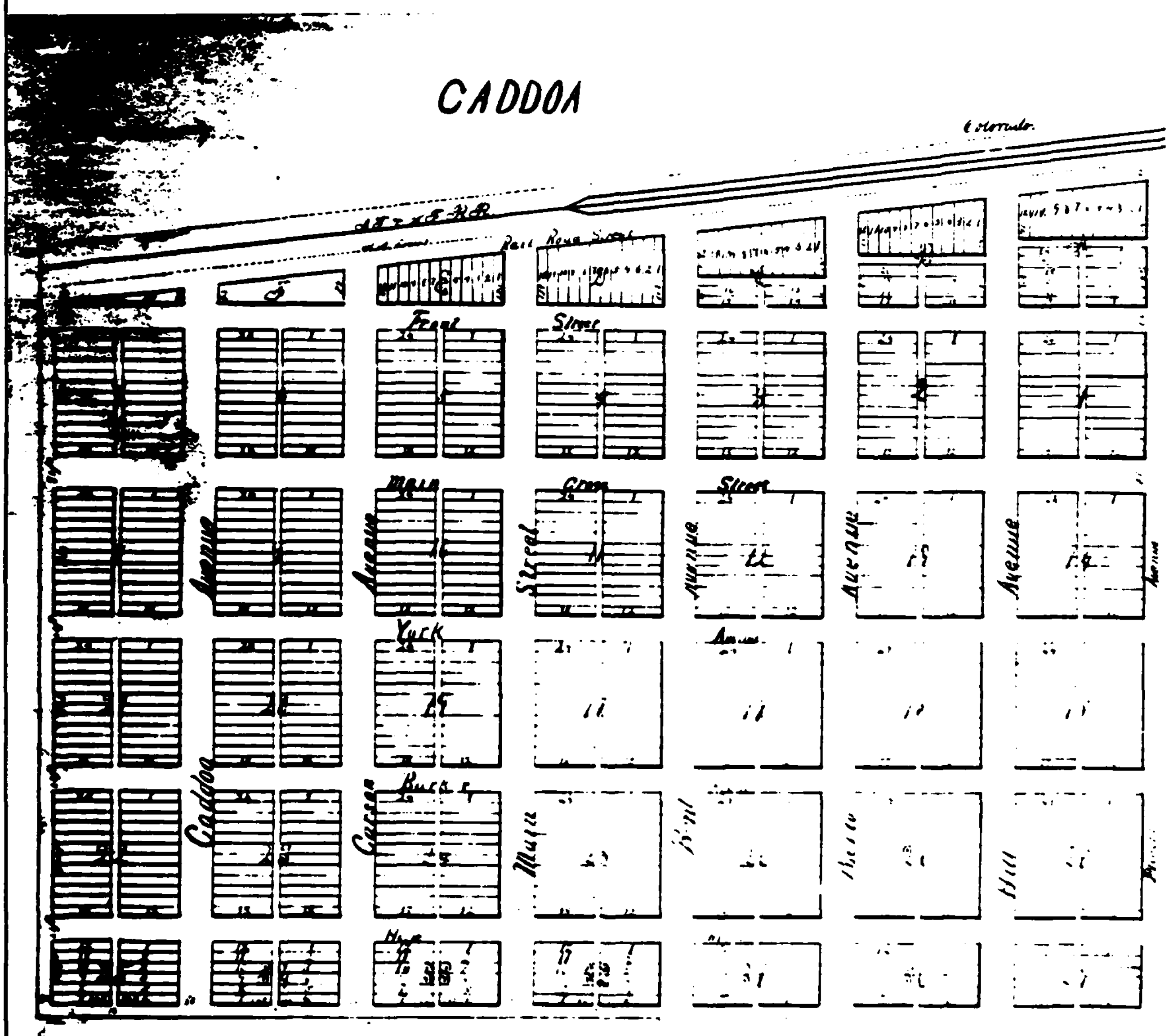
Town building in the Arkansas River Valley can be tied to three distinct periods. The first period, from 1873 to 1875 saw the first tracks being laid in the valley, and the towns of Las Animas and La Junta can both be dated to this time. During the second period, speculation over additional railroad facilities combined with the expansion of agricultural activities due to the construction of major irrigation projects promoted the growth of towns such as Lamar, Rocky Ford, and Caddoa. The last period of town building was related to the boom associated with the introduction of the sugar beet industry into the valley, and towns like Swink, Holly, and Sugar City all owe their birth to the construction of sugar plants at those locations.

The years 1886 to 1889 was the second time when rumors of railroad construction stimulated intense interest and speculation in the Arkansas River Valley. A number of schemes were put forth towards the expansion of additional railroad facilities in the valley, but none came to fruition. At various times the Missouri Pacific, the Burlington, and the Rock Island Railroads all considered extending their lines through the Arkansas Valley to Pueblo. None of these projects ever got past the paper stage, but some contributed to regional growth. In 1887, for example, the Caddoa Land & Town Company was formed by the Trostel brothers, Fred, Carl, and George. They surveyed and platted a town they called Caddoa along the Santa Fe Railroad in the SE 1/4 of Section 12, T.23S., R.50W (Figure 7.2). Caddoa was created to compete for becoming a division point on the proposed extension of the Rock Island Railroad. However, when the Rock Island built to Colorado Springs instead of taking the Arkansas River route, Caddoa was doomed to relative obsurity (Van Hook 1933; *Denver Post* 11 December 1941).

Caddoa, although never a large town, survived as a local shipping point for the surrounding ranches, and as a section station on the Santa Fe Railroad. In 1890 the *Colorado Business Directory* listed Caddoa as one of the many small towns in Colorado "where at present there is no business." In 1900 the Directory listed Caddoa as "Station on the A.T. & S.F. Ry., in Bent County. Agriculture and stock raising the leading industries. Population 50." The U.S. manuscript population census showed that in 1900 Caddoa actually had a population of 223 people. Men made up 50% of the total population of Caddoa, women 18%, and children 32%. The mean age was 32 years old, but 56% of all adults were between 30 and 16 years old. The town was 76% white, and 97% native-born Americans. The only significant ethnic group were Hispanics, who represented 24% of the total adult population. These people came mainly from New Mexico, and worked as railroad section hands or agricultural laborers. The importance of agriculture was reflected by the fact that 39% of all adult men worked in some agriculturally related field. The railroad was the next most important economic force in town, employing 31% of all adult men. In 1900, 59% of the adult male work force could be categorized as unskilled or semiskilled, 13% skilled labor, and 19% entrepreneurs or professionals. A more complete analysis of the census data can be found in Section 9.0.

Caddoa enjoyed a slight boom between 1900 and 1920, probably tied to the increasing in homesteading activities related to the expansion

FIGURE 7.2
1888 PLAT MAP OF CADDOA
JOHN MARTIN RESERVOIR PROJECT



COURTESY OF "ENT COUNTY CLERK, LAS ANIMAS, COLORADO.

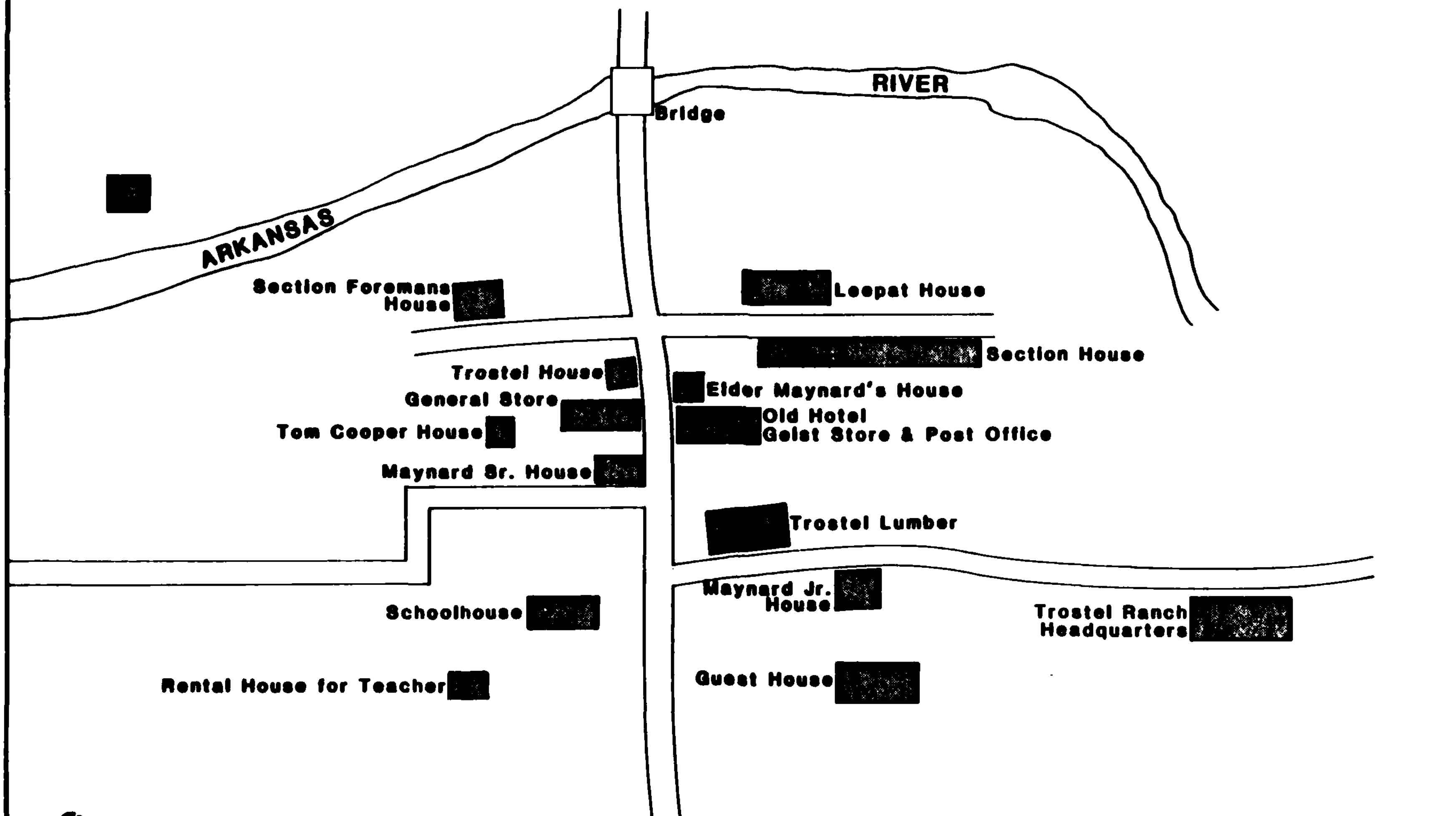
of the dry farming movement on the plains. The 1920 *Colorado Business Directory* listed a hardware store, a lumber company, a store, a restaurant, and an automobile garage in town. One local informant who first came to the region in 1911 recalled that at that time Caddoa had two grocery stores, a post office, a hardware store, a bar, and a hotel. Ben Davis ran one of the grocery stores. The Trostel brothers ran the hardware store (Harold Sorenson: pers. comm., August 12, 1980). A woman who taught at the school in Caddoa in the early 1930s remembered that by then the hotel was run down. She thought that rooms were rented there until around 1917, and meals were served at the hotel as well. By 1930 the old hotel was used by Mr. Geist as a store (Figure 7.3). The Trostel brothers ran the lumber yard and hardware store. The other general store was owned by John Marleman, but operated by Mr. Lowdy. The Maynard family ran the garage. The section house was an important part of the community, and most of the railroad hands lived there. The railroad section hands were mainly Hispanics, and it is interesting to note that the Caddoa school was divided into two classes, one for the white children and one for the Mexicans (Dorothy Boyd: pers. comm. August 12, 1980).

The most important people in town were the three Trostel brothers. They had come out west from Iowa to enter into the cattle ranching business and purchased the old John Prowers ranch. They formed the Caddoa Land & Town Company to promote the sale of lots in Caddoa, and later used the Caddoa Land & Investment Company to control all their property. When the federal government went in to condemn the land including the town of Caddoa during the construction of the John Martin Reservoir, it was found that the Trostels owned most of it. The town of Caddoa was evacuated in January 1942. Before construction of the dam was begun Caddoa "consisted of an old stone store and a dozen smaller frame structures" (*Denver Post* December 11, 1941). During construction, however, the town was used as a temporary place of residence for many of the workers on the dam, and a transient village of tents and trailers had sprung up. The original site of this town was flooded when the reservoir was filled, but a few of the houses and the post office were relocated a few miles to the southeast by the U.S. Army Corps of Engineers. The post office for New Caddoa was closed in 1958 (Shaffer 1978:54).

As the public lands in southeast Colorado were filled, and towns sprung up, the need for a military installation diminished. General Orders No. 69, issued by the Adjutant General's Office on 31 August 1889 directed the Department commander to abandon Fort Lyon. The troops were transferred elsewhere and the post was left in the hands of a caretaker. In 1906 the U.S. Navy took over Fort Lyon and used the post as a tuberculosis sanitarium. It was thought that the dry climate of the high plains was healthful. During the first World War, German prisoners of war who were ill were sent to Fort Lyon. The Navy used Fort Lyon for 15 years, and then turned it over to the U.S. Public Health Service in 1922. A few months later the base was acquired by the U.S. Veterans Bureau (now the Veterans Administration) and in 1929 Fort Lyon was converted into a neuropsychiatric hospital, a purpose it serves today (Boyd 1967).

It was the extension of irrigation efforts which led to the full development of the resources of the Arkansas River Valley. There had been attempts at irrigation in this region since the days of the fur trade. Some of the first settlers on the Greenhorn and Huefano had irrigated small tracts. In 1859 the first permanent settlers at Pueblo took a ditch out of Fountain Creek. Most of the early irrigation efforts were small affairs. The first cooperative ditch of any size in the Arkansas Valley, begun in 1861, was nicknamed the Cornmeal Ditch because its builders subsisted mainly on corn meal while building it. Settlers further down the river built

FIGURE 7.3
MAP OF CADDOA IN THE 1930s
JOHN MARTIN RESERVOIR PROJECT



SOURCE: Mrs. Dorothy Boyd, Las Animas, Colorado.

the Rocky Ford Ditch which supplied water to the first melon patches in the area (Baker ed. 1948:128). At Boggsville a ditch built by Thomas Boggs, John Prowers, and Robert Bent irrigated over 1,000 acres (Bowman 1881).

Individual and cooperative efforts were not sufficient to meet the irrigation needs of the area so in the 1880s and 1890s large corporations, often backed by out of state capital, began the construction of major ditches. Three of these canals, the Fort Lyon, Bob Creek and Otero can be credited with helping to turn the Arkansas Valley into a productive agricultural area. Theodore C. Henry was the genius behind the major ditches of this period. It was Henry's dream to see a canal built all the way to the Kansas border. In 1885 the Fort Lyon Canal, which took water from the north side of the Arkansas River about two miles west of La Junta, was listed in the State Engineer's Report as belonging to the Arkansas Land, Town, and Canal Company. In the spring of 1886 it had been extended as far as Sand Creek. T. C. Henry became involved in the project and saw the total number of acres irrigated by the Fort Lyon ditch increased to 40,600 by 1890. Henry also promoted the construction of the Bob Creek ditch, known as the Colorado Canal (Van Hook 1933). In 1890 Henry convinced a group of Buffalo, New York capitalists to form the Colorado Land and Water Company to finance the venture. Although this canal stretched only 74 miles eastward from Boone when all the original capital of $350,000 had been spent, it nevertheless laid the foundation for the introduction of the sugar beet industry in the area (Markoff 1978).

Sugar beets were introduced into the Arkansas River Valley as early as 1890 by the United States Department of Agriculture. When the original investors in the Colorado Canal failed to make a profit they reorganized the company into the Twin Lakes Land and Water Company and the Twin Lakes Reservoir Company, built a reservoir on Lake Creek, and proceeded to promote the raising of sugar beets as a commercial crop on the 35,000 acres of land they owned in the Arkansas Valley. In 1899 those same Buffalo capitalists formed the National Beet Sugar Company and built a factory and town, known as Sugar City (Markoff 1978). Meanwhile another sugar company, the American Beet Sugar Company, built a factory at Rock Ford in 1900. Other sugar beet factories were opened in Holly and Lamar in 1905, at Swink in 1906, and in Las Animas in 1907. By 1925 some 31,733 acres along the Arkansas River were in sugar beets (Baker ed. 1948:147). Many of those employed in the sugar beet industry were Germans and Russians from the Volga region.

After the turn of the century alfalfa emerged as the single most important crop in the Arkansas River Valley. By 1924, 43% of all irrigated land along the Arkansas was devoted to this crop (Baker ed. 1948:143). Associated with it came the alfalfa milling industry and stock feeding. Other crops grown in the valley included melons, corn, and onions.

In addition to irrigation, some settlers attempted to use dry farming methods. The first big influx of dry farming homesteads came in the late 1880s when several successive years of good harvests somehow convinced people that the rain belt had shifted far enough west to make dry farming profitable in the region. But a series of dry years in the 1890s resulted in crop failures and the abandoning of some claims. Federal legislation, such as the Dry Farming Act of 1909 and the Stock Raising Act of 1916, which increased the amount of acreage which could be homesteaded, and favorable climatic conditions, again led to an increase in settlement and a revival of the dry farming movement in the Arkansas River Valley (Van Hook 1933). By 1920 it was said that every 320 acre parcel in the area was taken up (Dorothy Boyd: pers.

comm., August 12, 1980). During the 1930s, however, a regionwide drought turned parts of southeastern Colorado into a portion of the famous "Dust Bowl." The drought and the Great Depression drove many people off their land.

The final chapter in the history of the project area concerns flood control. In 1921 the city of Pueblo was devastated by a flood. John Martin, a local Congressman, immediately began to push for federal flood control for the area. Arkansas Valley boosters saw the dam as an opportunity to generate more irrigation water. As early as the late 1920s, they began to promote the idea that the federal government should take on the responsibility of constructing a reservoir near the town of Caddoa (*Denver Post* February 12, 1928). At first known as the Caddoa Dam project, the name was changed to the John Martin Reservoir in 1940, shortly after the Congressman's death. Local authorities were able to convince the federal government of the need for this facility and the project was authorized under the Flood Control Act of 1936, as revised by the Flood Control Act of 1938 (COE 1976). Construction was begun in the fall of 1938, but was disrupted by World War II. The dam and reservoir were finally completed in October of 1948, at a cost of $15,233,366. This project provides irrigation water for downstream users in eastern Colorado and western Kansas, helping to turn the Arkansas River Valley into the fertile region the early Spanish explorers had once predicted it would be.

7.1.7 SUMMARY

The history of the John Martin Reservoir Project Area, illustrated in Figure 7.4, shows how it developed from a place once considered by early American visitors to be a barren desert best left to wandering tribes and buffalo into a rich agricultural region. The Arkansas River played a major role in the determination of this area's history. The river served as a route of travel utilized over time by Native Americans, Spanish explorers, American expeditions, trappers, and traders. Along the Arkansas the Bent family built the fort which served as the heart of their fur trade empire. After the decline of the fur trade, and the removal of native tribes, Euro-Americans began to take advantage of the area's usefulness for stock raising. With the arrival of railroads, and the expansion of irrigation projects, towns grew and new settlers were attracted by the agricultural potential of the Arkansas River Valley. But the river could be destructive, and a flood in 1921 led to plans which culminated in the construction of the John Martin Dam and Reservoir.

The historical narrative above outlines the major trends and events which influenced the development of the region as drawn from historical documents. This information is presented along topical lines, which highlight significant activities and periods. These episodes include: 1) *Native American Occupation and Early* Exploration, 2) Trails, Trappers, and Traders, 3) Removal of the Native Americans, 4) Euro-American Settlement, 5) The Open Range Cattle Industry, and 6) Homesteading, Irrigation, and Flood Control. Using these topics, a series of research questions were developed to examine whether or not the archeological and site-specific archival data agrees with the generally accepted historical interpretation of this region's past.

7.2 REGIONAL RESEARCH QUESTIONS

The purpose of this section is to outline the theoretical background for the Historic Research Design. It was the intent of the historical research to deliniate broad historical trends for the region in general, as well as examining historic settlement patterns in specific terms. The historic research questions which follow are meant to focus attention on certain topics of inquiry which should more clearly define the regional patterns

FIGURE 7.4
HISTORICAL CHRONOLOGY CHART

Date	Cultural Occupation	Economic Activities	Historic Phases	Events
1938			Flood Control	Construction begins on John Martin Dam
1930			Drought and Great Depression	
1921				Arkansas River flood
1900	Volga Germans	Sugar Beet Industry		
			Irrigation Ditches	
1887				Town of Caddoa founded
		Farming and Stock Raising		
	New Mexican Hispanics		Homesteading begins	
				Hard winters hurt cattle industry
1873			Town building and the arrival of the railroads	West Las Animas
1869				Old Las Animas
	Removal of Native tribes			
1867				New Fort Lyon
	Euro-Americans	Open Range Cattle Industry		
			Permanent Euro-American Settlement	
1864				Sand Creek
1860				Old Fort Lyon Boggsville
1854				Bent's New Fort
1848			American Political Control	Treaty of Guadalupe Hidalgo
1834				Bent's Old Fort
	Cheyenne	Fur Trade Era		
			Santa Fe Trail	
	Arapahoe			
1820				Long Expedition
	Kiowa			
1806			American Exploration	Pike Expedition
	Comanche			
1706				Ulibarri
	Plains Apache		Spanish Exploration	
1540				Coronado

being investigated.

The analysis of the historic sites located during the John Martin Reservoir Project combined two separate, but related, disciplines. The first is historical, or archival, research. This meant the use of written records to aid in the interpretation of the past. The second discipline used archeological methods. This addressed the actual on-the-ground physical remains of human occupation at a site. Hopefully, the synthesis of the historical and archeological data will make a meaningful contribution to a better understanding of past human behavior and the dynamics of cultural evolution during the historic period in the John Martin Reservoir Project area.

The historical research for the John Martin Reservoir Project took a divided approach. The irst task was to identify the broad historical trends, significant events, or famous people associated with this region. To accomplish this, a thorough knowledge of the pertinent, secondary literature dealing with this area was necessary. The historiography of these periods and events was examined to determined how historians have interpreted this region's past. Using the information gathered during this phase, the Historical Regional Overview (Section 7.1) was written.

The second task was site specific in nature. It aimed at presenting a short history for every historic archeological site recorded during the survey. The individual site histories were researched using public documents available at the Bent County archives in Las Animas. Federal patents gave information on dates of occupation and settlement patterns. Deeds provided data on ownership and land tenure. Assessment rolls indicated land-use and wealth. Local records were supplemented with other types of primary sources. The United States Manuscript Population Census sheets, for example, were used to answer questions about demographic trends. Oral history, collected through interviews with longtime area residents, was another means of fleshing out social realities or perceptions of the past. Other primary sources of information included newspapers and business directories. Having gathered the site-specific information, it was possible to use quantitative methods to arrive at generalizations about historic patterns in the project area. The methodology used to analyze the site-specific data will be explained in Section 7.3.

The archeological approach to the historic sites concentrated on information obtained from visual observations about the on-the-ground physical remains. It was the goal of the archeological investigations to examine both intrasite and intersite patterns. On the specific level the features of each site, its associated artifactual assemblage, and its geographic setting was described. On a more general level, sites of similar time range, function, and cultural affiliation were contrasted and compared.

Using the two independent, yet complimentary, disciplines of history and archeology, a wide range of topics were examined. On a broad level, regional settlement patterns and demographic trends were investigated. On a site-specific level, such factors as chronology, function, land use, ethnicity or cultural affiliations, and wealth or socioeconomic relationships were studied. These topics are discussed below in terms of the different methodological approaches which were taken to answer the reseach questions raised. It is not assumed that these research questions cover all the possible topics which could be considered. Rather, they are presented as the starting point for the analysis of the data collected during the fieldwork.

7.2.1 CHRONOLOGY

In an archeological context, the time range of a site can be derived from the style, form, manufacture, and function of its features or from its artifactual assemblage. Architectural styles, local building traditions, and certain functional attributes are all chronologically diagnostic and may indicate the date of construction at a site, or its period of occupation. Artifacts are also useful in determining the dates of occupation for a site. The type or style of manufacture, the material used, the form, and function of the artifact are all indicators of its temporal limits. Stanley South, for example, has used mean ceramic dates to determine the period of occupation of British American sites on the East coast (South 1978).

There are many sources which may be consulted to identify artifact traits and their period of manufacture. Old trade catalogues, such as the mailorder catalogues put out by Sears, Roebuck, and Company, contain a large array of artifact types and indicate when the item was popular. Back issues of newpapers contain similar kinds of information in the form of advertisements. Scholarly journals, like *Historical Archaeology*, and other archeological reports and publications contain articles or sections dealing with the identification of historic artifacts and offer comparative collections for study. In addition, the rise in popularity of antiques has resulted in the publication of numerous speciality or collector's books, like Goden's (1974) work on British porcelain, or Toulouse's (1971) book on glass bottle maker's marks. These sources are great aids in determining the period of manufacture for certain artifacts.

The dates of occupation for a site-derived from archeological data, such as the time range of the artifactual assemblage found there, can then be compared to the dates of occupation derived from historical sources. In the case of historic Euro-American farmsteads, for example, the date of the homestead claim or federal patent for the land, together with the appearance of the owner's name and property in the local assessment rolls, is a good indication of the earliest date for the occupation of that site.

There are several questions about chronology which can be raised on the site-specific level. What is the time range for historic settlement in the John Martin Reservoir Project Area? What are the specific dates of occupation for each historic site? Was a certain kind of site occupied during a certain time period?

In addition to the site-specific questions there are also problems which can be pursued on a regional level. It is a historic technique to use chronological events as major themes throughout a narrative. Such an approach was taken in the Historic Regional Overview. A series of regional research questions is offered below, organized along the same chronological themes as presented in the Historic Regional Overview.

7.2.1.1 NATIVE AMERICAN OCCUPATION AND EARLY EXPLORATION

Native Americans occupied the John Martin Reservoir project area for thousands of years, before the arrival of Euro-Americans. In historic times, there was a great deal of change in the demographic and ethnographic composition of the groups living along the Arkansas River. The Plains Apache were replaced by Ute and Comanche, and later Cheyenne and Arapahoe came down from the north to occupy the project area. How do historians account for these changes? How did Native-American and Euro-American groups interact? What factors lead to the bloody conflict between native tribes and Euro-American settlers which eventually resulted in the removal of Native Americans from the region?

In 1803 the United States acquired the Louisiana Territory, and three years later Zebulon Pike was sent out to examine its southwestern border. After Pike, the American government sent other expeditions into the region. Such famous military explorers as Stephen Long, John C. Fremont, Stephen W. Kearny, and John W. Gunnison visited the project area and recorded their impressions. What were the political implications behind these official military expeditions? How did these explorers influence American opinions and shape future attitudes towards this region?

7.2.1.2 TRAILS, TRAPPERS, AND TRADERS

When Pike traveled up the Arkansas River in 1806, he noted that it was already utilized as a "Spanish road." In 1821 this route became part of the famous Santa Fe Trail. What events helped to establish this important highway of trade? How did the use of the trail affect the development of the region?

As early as 1812, a party of American trappers led by Ezekial Williams hunted beaver along the upper reaches of the Arkansas River. By the 1830s the fur trade dominated Euro-American activity in this region. No group of trappers or traders were more influential in this area than the firm of Bent, St. Vrain & Company. What was the role played by the company? What did American trappers and traders contribute towards the eventual permanent settlement of the region?

7.2.1.3 THE OPEN RANGE CATTLE INDUSTRY

After 1859 southeastern Colorado was dominated by the open-range cattle industry. Many of the early ranchers in this region also played a part in the establishment of the first towns. What factors led to the rise of the cattle industry? What did ranchers contribute to the settlement of the area? Why did large-scale cattle operations begin to decline in the late 1880s?

7.2.1.4 EURO-AMERICAN SETTLEMENT

Permanent Euro-American settlement of the project area began after 1860. Towns were founded and people started moving into the area. What events or factors allowed settlement to occur at that time? Some towns prospered while others faded from existence. What role did the arrival of the railroad play in the growth and success of towns in this area?

7.2.1.5 IRRIGATION AND FLOOD CONTROL

After the 1880s cattlemen were challenged by an influx of homesteaders to the region. If the Homestead Act was passed in 1862, why were farmers so late to take up claims in this area? How did the regional economy develop, and what role did small ranchers and farmers play in it? How did irrigation contribute to the further settlement of this area? How did fear over the flooding of the Arkansas River lead to the construction of the John Martin Dam and Reservoir?

7.2.2 FUNCTION

On a site-specific level, archeological methods can be of great use in the establishment of functional categories and site types. The arrangement of physical features at a site usually indicates its function. For example, an alignment of sandstone foundation blocks associated with a scatter of domestic artifacts would indicate that the site was once a residence. For the John Martin Reservoir Project Area, the range of historic site types was expected to include: (1) historic Native American camps; (2) early Hispanic sites; (3) temporary camp sites related to

early American exploration, the fur trade, or the use of the Santa Fe Trail; (4) ranch related sites; (5) farms or homesteads (6) town sites; and (7) transportation related sites.

The function of historic sites can also be determined through the historical record. Town sites, old trails, early ranches, and roads can be located on various maps of the region. The economic function of a homestead, whether it was used primarily to raise livestock or crops, can be found in the local assessment rolls.

On a regional level, it should be possible to group sites of similar function together and examine them more closely to determine the similarites or differences in their features or artifactual assemblage. The kind of sites encountered during the survey will point out the major activities for the region, and give some indications about land use. It will also show what kind of historic sites survive, and what kind of sites are more elusive in terms of the archeological record.

Some research questions concerned with function might include the following: What kind of sites are located in the John Martin Reservoir project area? How do these sites reflect economic activities or land use? How do they reflect historic settlement patterns? Are sites of similar function also from the same time period? What kinds of sites are not found during the survey?

7.2.3 ETHNICITY

The cultural occupation or ethnic associations of a site may be discovered through several methods. Archeologically speaking there are certain kinds of features or artifacts which indicate that a certain ethnic group used the area or was associated with the site. For example, the association of so-called "Colono-Indian Ware" pottery with Afro-American sites in the southeastern states (Ferguson 1980).

Historical research is another means of determining ethnicity or cultural affiliations. An examination of local deeds and assessment rolls will give the names of the owners of the property containing the site. Many names are clues to the ethnic identity of the owner. However, the manuscript version of the U.S. Population Census is more accurate. These documents give the place of birth of every person listed, along with the place of birth of their parents. It should be pointed out, however, that the owner of a piece of property may not necessarily be the inhabitant of the site on that tract of land.

There are a few research questions about ethnic associations which might be addressed. What ethnic groups are known to have resided in the area? Do any sites reflect the presence of these ethnic groups? Is there any correlation between certain features or artifacts found at any of the sites and certain cultural or ethnic groups?

7.2.4 WEALTH

The archeological data will allow some assumptions about wealth and socioeconomic status to be generated. For example, the greater the number of artifacts found at a site, the greater the assumed ability of the occupants of that site to acquire material goods. Some artifacts have a more direct relationshp to status or wealth than others. For example, some types of ceramics are known to cost more than others. At one site a higher percentage of porcelain may be found, while another site is dominated by earthenware pieces. It can be presumed that the occupants of the first site were in a better finanical position than the occupants of the second site.

Historical documents can also provide information on wealth. The local assessment

rolls will show the size of a landholding, its assessed value in dollars, the value of improvements on the property and a listing of personal property. This kind of information is an excellent gauge of the relative wealth of the owners of a given piece of property. Again it should be pointed out that the owners of a tract of land may not be the occupants of a site on that land.

On a regional level, the data acquired during the site-specific investigations can be used to develop generalizations about socioeconomic relationships in the area. It can explain who controlled the most land, what the average size of a landholding was in the project area, the average assessed value of the land, and the amount of time the average family held onto the property. It will also indicate what the land was used for, whether farming or ranching.

Some questions about wealth should be mentioned here. Are differences in wealth reflected in the archeological record for the historic sites in the project area? What are the major economic enterprises being carried on in this region? Were ranches or farms successful economic units?

Most of the historic research questions discussed in this section were general in nature. More specific methodological approaches to research problems will be addressed in Section 7.3.

7.2.5 SUMMARY

The above section discussed how the complementary disciplines of history and archeology can be used to interpret the historic sites located during the survey. Methodologically this can be done on both a regional and site-specific level. On the regional level, important events and trends can be isolated. On the site-specific level, each site discovered within the project area can be researched. Both tasks were employed during the conduct of the investigations to examine specific research topics. The topics which were focused on included: 1) Chronology, 2) Function, 3) Ethnicity, and 4) Wealth. The regional research questions provided a background for the analysis of the data collected during the fieldwork. Each topic presented here was examined in light of the information gathered during the survey. The results of the investigations can be found in Section 9.0.

7.3 JOHN MARTIN RESEARCH QUESTIONS

The historic research design is the framework for the analysis of the data recovered in the field. A series of historic research questions has already been presented in Section 7.2. The section which follows aims to identify some of the biases in the theoretical orientation of those research questions. It examines both the limitations of the methodologies used, and the limitations of the data base itself. It also seeks to point out the different approaches taken toward the solutions of these problems. This design presents a series of hypotheses and a model for their testing. It is an explanation of the methods and techniques used in the interpretation, analysis, and evaluation of the information obtained from the historic sites.

7.3.1 PROBLEM ORIENTATION AS A BIAS

The major biases in the problem orientation for the anaylsis of the historic sites located during work on the project are tied to the limitations of either the methodologies employed or the data base. There are certain philosophical biases inherent in the academic orientation of the two disciplines used to interpret the historic sites. The integration of historical and archeological methods can help answer many of the questions raised in this research design, but there are problems which must be recognized. There are

also limitations in the sources utilized. It is the ability to assess the quality of the data being consulted which determines the quality of the analysis.

7.3.1.1 METHODOLOGICAL BIASES

The historical research design for the John Martin Reservoir Project took advantage of two approaches to the analysis of historic sites: history and archeology. Each approach has its own strengths and weaknesses. Like the archeologist, the historian is interested in delineating the course of human occupation and cultural change. Patterns of settlement, demographic trends, cultural affiliations, land use, and socio-economic relationships are all topics which can be examined through historical research. For the historian written records serve as the basis for the interpretation of the past. The historian is limited in his ability to interpret past events by the quantity and quality of the records which survive. To be able to discern the biases of the source material, separating the actors from the observers, and isolate outside forces are some of the keys to the historian's craft.

Certain biases in the historical method must be understood. Firstly, historians can only interpret the past within the context of their own culture or society. As Charles Beard pointed out in his 1933 presidental address to the American Historical Association, "each historian is a product of his age, and that his work reflects the spirit of the time, of the nation, race, group, class, or section" (Hodgen 1974:10). Secondly, the biases of the historian's personal views will be reflected in the way he evaluates the data available. Every set of historical events may be interpreted differently by different historians. Debates over the cause of the American Civil War are a prime example. Although the events which led to this conflict are well known, each generation of historians has managed to present a different opinion about what those events mean. Thus one group of historians claim slavery caused the Civil War, while others point to economic factors, or the question of States Rights. Margaret Hodgen wrote that history may be considered a double-barreled term, "meaning both what happened and the historian's statement of what happened" (Hodgen 1974).

In an attempt to correct those biases, this research design takes an anthropological view of history. It used archeological methods to help fill in the gaps in the historical record. It also used social science techniques to aid in the analysis of historical data.

Since all documents do not survive, the historical record is almost never complete. The records which do exist are often selective in nature, and only tell part of the story. These documents, for the most part, represent the products of the literate portion of the society. Archeology is one means of recreating the history of the inarticulate. As James Deetz has written:

> In spite of the richness and diversity of the historical record, there are things we want to know that are not to be discovered from it. Simple people doing simple things, the normal, everyday routine of life and how these people thought about it, are not the kinds of things anyone thought worthy of noting (Deetz 1977:8).

Archeology can also be used to assess the accuracy of the written record. It is common to find discrepancies between physical remains found at a site and what the documents say should be there. For example, the foundations of a house are found during an archeological survey, yet the building never appeared in the local assessment rolls. Oral history also needs to be corroborated from other souces, because human memory is selective. In his study of Mott Farm, Marley Brown discovered that former residents of the property could not even remember where

their household privy had been located (Brown 1978).

But archeological evidence also has biases. Although a range of artifacts may be recovered from a site, it is the methods of analysis and interpretation of those artifacts which color the reconstruction of the history of that site. There are also gaps in the archeological record. Because of soil acidity, rodent activity, vandalism, and other factors, the full range of features and artifacts may not be present at a site. Here historical documentation can aid in the reconstruction of the period of occupation and the activities which took place at the site.

7.3.1.2 INFORMATIONAL BIASES

The shortcomings of the data base must also be acknowledged. In the case of archeological information, observations based on visual inspection of a site may be subjective, but fairly accurate. The site was at least seen in its environmental context. Problems arose in the methods of recordation. Mapping was done with a Brunton compass mounted on a tripod and a 50-m tape measure. This method, while adequate for most sites, is not as accurate as other techniques, such as the use of an alidade and plane table. Inconsistencies between field crews also affected recordation. The amount of detailed description of specific features varied, due mainly to the limitations of time. Artifacts at each site were flagged and listed on the mapping forms. At sites where many artifacts were encountered only 100 were flagged and described. This, of course, is not an accurate sample of the artifactual assemblage. Most field crews, however, were careful to try and include the full range of artifact types present, if not in the exact proportions of their distribution across the site.

The limitations of the historical sources consulted during this project will also be discussed. First of all, most public records for Bent County only date to after 1887, because that year the Courthouse burned down. This was not considered to be a major set-back for this study, because this region was homesteaded relatively late and most of the sites date to after 1887. The earliest date for the occupation of historic sites in the project area was usually based upon the date of the federal patent for the tract of land containing the site. It should be pointed out that the Homestead Act of 1862 required claimants to reside on the land for five years and make improvements upon it before a patent would be granted. There is the possibility that some homesteaders waited considerably longer than five years before filing for a patent. In other localities it is not uncommon to find that the property in question would not be patented until just before it was sold by the orignal owner. However, in the case of the John Martin Reservoir project area, it is possible to check the date of patent against other sources, such as the assessor's tract maps and assessment rolls. It was found that there was a high correlation between the date of patent and the year the owner of the property was found listed on the assessment rolls. This meant that people in this region tended to patent their land as soon as it was legally possible, and this was reflected in the fact that they would appear on the tax lists about the same time they acquired the property.

The Bent County Assessment Rolls presented another set of problems. The tax lists began in 1887 and continue to the present. There was also a limited number of Assessor's Notebooks which exist for the period from 1919-1930. On the whole, the assessment rolls were checked for each decennial period: 1890, 1900, 1910, 1920, and 1930. Other years were sometimes checked for supplementary information. The Assessor's Notebooks, for example, were examined for the years 1919, 1924, and 1929. The Bent County Assessment Rolls listed property owners alphabetically. They gave the name of the property owner, the place of residence in general terms

(i.e., Las Animas) the legal description of the land using survey boundaries (i.e., NW¼ of Section 1, T22S, R50W), the number of acres in the tract, the assessed value of property, the value of improvements on the land, the value of personal property, and the amount of tax owed. Unfortunately, the Bent County Assessment Rolls do not separately list out the improvements. Only in 1910 did the tax rolls enumerate personal property. For that year it was possible to discover how many cows or sheep the person owned. For the years 1910, 1920, and 1930 the assessment rolls made the distinquinsion between grazing land and irrigated farm land. Thus, for those years land use for the property can be determined from the local records.

One problem with the assessment rolls was that while most property owners were listed, some were not. Thus for some sites, although the name of the property owner is known from patent or deeds, that person could not be located on the tax list. Another problem was that only property owners were listed on the assessment rolls. This would exclude the possibility of finding any information about nonowners who resided at a site, such as tenants.

The Bent County Deeds were another profitable source of information. They gave the date when a piece of property was sold and listed the names of both the seller and the buyer, usually telling the residence of both (listed by county and state), the legal description of the property in question, and sometimes the amount of money it sold for. In this region most property transactions were recorded as "for a valuable consideration," not noting the dollar amount of the sale. Sometimes the deeds included restrictions or gave other kinds of information about land-use, water rights, and improvements on the property. Again deeds usually only listed the property owners, and thus contributed little information about possible tenants living at a site. Deeds were a good indication of land tenure, showing how often a piece of land was sold. The reason for the sale, however, was usually a matter of conjecture.

It was hoped that the manuscript sheets of the United States Population Census could be used to identify specific individuals associated with the historic sites found during the survey. However, this was not feasible because such a large percentage of the sites dated to after 1900. The manuscript census sheets are only available to the public for the decennial years 1900 and prior. In the case of Bent County, Colorado, the first U.S. Census was taken in 1870. The other census years available are 1880 and 1900. The 1890 Manuscript Population Census is not available because it was destroyed in a fire in Washington, D.C.

Instead of using the names of people associated with individual sites, it was decided that named localities within the project area had to be used to provide the demographic data. It was assumed that the population of the towns was similar to the composition of the rural countryside. This seemed to be reinforced by the high percentage of agricultural related occupations found in the towns. There are only two townsites in the project area, Old Las Animas and Caddoa. Today Caddoa lies under the waters of the John Martin Reservoir and therefore could not be recorded. The location of Old Las Animas was discovered during the survey and recorded as JM043. The "village of Las Animas" was found as a named location in the 1880 U.S. Census. It was not listed in any other year. Caddoa was listed in the census only in 1900. The manuscript census sheets provided data about the size and composition of the population of the towns. It gave the age, sex, marital status, children, ethnic background, place of birth, and occupation of each person listed. This information was analyzed using quantitative techniques to answer the research questions and testable hypotheses presented below.

7.3.2 ASSUMPTIONS, HYPOTHESES AND TEST IMPLICATIONS

During the analysis phase of this project, an attempt was made to quantify some of the data collected during the field work. The hypotheses and test implications which follow served as the outline for the quantitative analysis. They are presented in this report as variables which were coded, punched, and processed by computer. The research problems have been divided into historical (or archival) and archeological categories to reflect differences in methodology and in the nature of the sources used. The historical hypotheses focused settlement patterns and demographic trends for the region in general. They were based upon information collected during the site-specific archival research phase of the project. The archeological hypotheses tended to be more site specific in nature, comparing and contrasting site attributes. These test implications focused upon questions dealing with site function, chronology, and material culture. They were based on information about each site which was observed and noted during the site recordation and mapping process.

7.3.2.1 HISTORICAL HYPOTHESES

The kinds of historical variables which could be analyzed using social science techniques directly corresponded to the limitations of the archival data base as discussed in the previous section. The fact that local records detailing land use in the project area were not available before 1887 would exclude the formulation of testable hypotheses dealing with the Hispanic period, early American exploration, or the fur-trade era. However, these topics were not ignored. They were directly addressed in the Historic Research Questions.

The historical variables which were most directly quantifiable deal with settlement patterns and demographic trends (Figure 7.5). The questions concerned with settlement patterns were based on information acquired from the Bent County archives. The demographic questions were answered using data found in the U.S. census. The settlement hypotheses for the project are:

1. That most of the land was patented relatively late, probably between 1880 and 1900.
2. That a few people controlled most of the land.
3. That a significant number of acres were controlled by out-of-state investors.
4. That most of the land was used for ranching or farming, with ranching decreasing over time and farming increasing.
5. That a significant percentage of the land remained in one family for a long period of time, and that the average turnover was low.
6. That businesses in the towns were oriented toward the rural economic base.

The demographic hypotheses are:

1. That there was no significant Euro-American population in the project area before 1870.
2. That the population of the region increased after the decline of the range-cattle industry and the arrival of the railroads.
3. That many of the early settlers were white Americans from the Trans-Mississippi West, but Hispanics also made up a significant portion of the population of the region.
4. That the area was settled mainly by single young men, and there were few women or children in the early historic period, although their numbers increased over time.
5. That the majority of residents of the region were employed in either ranching or farming.

FIGURE 7.5
LIST OF HISTORICAL VARIABLES

A. SETTLEMENT PATTERNS

Year of Patent
(earliest date of occupation)

Ownership of land
(local or outside county)

Number of times sold
(land tenure)

Longest time in one family
(in years)

Size of land holding
(in acres)

Assessed value of the land
(in dollars)

B. DEMOGRAPHIC TRENDS

Town and year of census
(Las Animas 1880; or Caddoa 1900)

Total population
(number of people)

Age
(for adults, 16 years or older)

Sex/Marital Status
(for adults)

Number of children
(for adults, head of household)

Ethnic background
(for adults: White, Black, Hispanic)

Place of origin
(for adults: state or country)

Occupation
(for adults)

6. That the rural population will be similar in composition to the population of the towns.

7.3.2.2 ARCHEOLOGICAL HYPOTHESES

The archeological variables were based upon information obtained during the inspection and recordation of historic sites in the John Martin Reservoir Project Area. The physical on-the-ground remains and the environmental context of the site determined the variables which best lent themselves to quantification. The basic test for these hypotheses was the comparision of site attributes. The testable hypotheses for the archeological variables are:

1. Sites will be classifiable by function. This will include farmsteads, ranch-related features, townsites, and trash scatters. It is expected that the kind of sites found during the survey will indicate land use in the region and directly correspond to the historical data.
2. Site attributes, such as features and artifacts, will reflect site function.
3. Site attributes will also reflect the period of occupation.
4. Sites of similar function and time range will show a similarity in their attributes.
5. Sites of similar time range and function that have different attribute patterns will exhibit these variations because of differences in socioeconomic status of the inhabitants, or differences in ethnic or cultural affiliations.
6. Sites located in the best environmental situation will be the most successful economic units. This may be reflected in the pattern of their attributes.

7.3.3 DATA VARIABLES AND ANALYTICAL METHODS NECESSARY TO TEST HYPOTHESES

After the fieldwork, during the analysis phase, the data collected was organized in a manner that allowed the hypotheses to be tested using quantitative methods. This included the examination of both archival and archeological information. Coding formats were developed and variables were isolated according to the topic of study. Three research topics, site attributes, settlement patterns, and demographic trends, were chosen as the headings for the data record. The information was coded, punched, and run through an SPSS computer program. One subprogram of this analysis isolated frequencies for nominal and ordinal variables. It gave the raw count, the percent frequency, and the cumulative frequencies. Another subprogram isolated condescriptive patterns for interval level variables. It produced means, modes, and variations. The variables which served as the basis for the data-coding systems will be discussed below. The results of the analysis are presented in Section 9.0.

The first part of the data record was titled "Artifact Variables and Site Attributes." It was designed to examine the kind of information described on the site record and mapping forms. Since a modified no pick-up policy was followed during the John Martin Reservoir Project, very few historic artifacts were collected in the field. Therefore, the analysis of historic artifacts was based upon the data recorded on the site forms rather than laboratory examination of collected artifacts. It was the artifacts listed on the mapping forms which were coded according to the variables listed below.

In order to compare artifact assemblages at each of the historic sites it was decided to create a system of classification using their attributes as variables. Such a system is similar to the one shown in South (1977:125-137). The intent of such a system was to determine if sites of similar function and time range have similar patterns of artifact distribution. The classification system broke the artifacts into broad categories, called

"Groups." Each Group was supposed to represent an activity area. The Four Groups were: Household, Architecture, Mechanical, and Personal. Within each Group was another level of categories called '"Classes," which were meant to denote the material from which the artifact was made. The various Classes included glass, ceramics, metal, wood, leather, cloth, stone, brick, and bone. Within each Class were numerous "Types," which represented the function of the artifact. For example, under the Class of ceramics was the Types of plate, bowl, cup, and crock. The last level of classification, under the Type categories, was "Ware," which denoted the kind of features which distinguished the artifact from others of the same Type. For example, under the Class of ceramics and the Type of plate might be the Wares of earthenware, stoneware, or porcelain. Figure 7.6 lists the full range of categories used during the coding of this system.

Not all levels of classification were noted in the field. More often than not the crews merely wrote down the Class and Type of artifact on the mapping form. Because of the vagueness of the recordation, only distinctions in the artifact patterns for Groups and Classes were made for the historic sites.

Site attributes were analyzed on the same data record as the artifacts. Again, the site forms, as filled out in the field, served as the source of this information. The attributes which were isolated included the site function, its location in relation to the Arkansas River (north side or south side), whether it was a single- or multi-component site, the SCS Range Site classification for the site location, its distance to permanent water, and the features present at the site. The observed function of the site was compared to the function as revealed in the historical records. Features were noted by their presence or absence at each site. A list of features can be found in Figure 7.7. The features present at each site were compared to see if sites of similar function have similar features. The location of the site in relation to the Arkansas River was used to determine if sites on the north side differ from sites on the south side. The distance to the nearest permanent water and the SCS Range Site classification showed which sites were located in the best environmental setting, and indicated what role environmental factors played in the location of historic sites. The coding format for the site attributes is shown in Figure 7.8.

The second section of the data record dealt with settlement patterns. This was an attempt to quantify the information collected from the Bent County archives during the site-specific phase of the historical research. The variables included the year of patent, number of times the property was sold, whether the ownership was inside or outside of Bent County, the size of the land-holding, the assessed value of the land, and the longest time it was held by any one family (Figure 7.9). The year of patent was a constant, as was the figure for the number of years it was owned by one family. However, the other variables were coded by decade (i.e. number of times sold between 1890 and 1900). The idea was to see if patterns of land tenure changed over time.

The third part of the data record was concerned with demographic trends. The data came from the U.S. Manuscript Population Census sheets for the towns of Old Las Animas and Caddoa. The variables consisted of total population, sex, and marital status of all adults (over the age of 16); the number of children for each adult head of household; the age of each adult; ethnic background of each adult; place of origin of each adult; and occupation of each adult (Figure 7.10). The product of this analysis showed how the composition of the population of the project area changed over time, since the Las Animas data is from 1880 while the Caddoa census is from 1900.

FIGURE 7.6
LIST OF HISTORIC ARTIFACT CATEGORIES AND CODE NUMBERS

Historic Analysis: Data Coding Format
Card 1 - Artifact Variables and Site Attributes

Column 13-14
A. GROUPS
- 01 = Household
- 02 = Architecture
- 03 = Mechanical
- 04 = Personal

Column 16-17
B. CLASSES
- 01 = Glass
- 02 = Ceramics
- 03 = Metal
- 04 = Wood
- 05 = Leather
- 06 = Cloth
- 07 = Coins
- 08 = Jewlery
- 09 = Armaments
- 10 = Stone
- 11 = Brick
- 12 = Bone
- 13 = Rubber/Plastic
- 14 = Coal

Column 19-20
C. TYPES
- 01 = Beverage
- 02 = Liquor
- 03 = Medicinal
- 04 = Condiment
- 05 = Tableware
- 06 = Kitchenware
- 07 = Plate
- 08 = Bowl
- 09 = Cup
- 10 = Crock
- 11 = Furniture
- 12 = Window Glass

TYPES (cont.)
- 13 = Construction Hardware
- 14 = Nails
- 15 = Barbed Wire
- 16 = Tin Siding
- 17 = Foundation Stones
- 18 = Doors (and Knobs)
- 19 = Electrical Insulators
- 20 = Plumbing Equipment
- 21 = Musical Instruments
- 22 = Bullets or Shot Shells
- 23 = Gun Parts
- 24 = Farm Implements
- 25 = Tools
- 26 = Automobile Parts
- 27 = Children's Toys
- 28 = Beads
- 29 = Buttons
- 30 = Scissors
- 31 = Buckles
- 32 = Tweezers
- 33 = Razor Blades
- 34 = Shaving Cup
- 35 = Pins
- 36 = Belt
- 37 = Shoes
- 38 = Shirt
- 39 = Pants
- 40 = Blanket
- 41 = Tobacco Pipe
- 42 = Keys
- 43 = Fragments (too small to identify, also coded as 00).
- 44 = Miscellaneous (included sales receipt and license plate).
- 45 = Barrel/and Parts

TYPES (cont.)
- 46 = Roofing Tin
- 47 = Wire Fragments
- 48 = Chimney Parts
- 49 = Cans
- 50 = Metal Spikes
- 51 = Pipe
- 52 = Vase
- 53 = Sheet Metal
- 54 = Bucket/wash Tub
- 55 = Barrel Rim (same as 45).
- 56 = Clock/clock parts
- 57 = Laundry Supplies
- 58 = Lamp/lamp Parts
- 59 = Cleaning Supplies

Column 22-23
D. WARES
- 01 = Milk Bottle
- 02 = Soda Bottle
- 03 = Wine Bottle
- 04 = Whiskey Bottle
- 05 = Pharmaceutical
- 06 = Dry Goods
- 07 = Water Glasses
- 08 = Table Glasses
- 09 = Canning Jars
- 10 = Jar Lids/Seals
- 11 = Earthenware
- 12 = Stoneware
- 13 = Porcelain
- 14 = Knife
- 15 = Fork
- 16 = Spoon
- 17 = Sauce Pan
- 18 = Dutch Oven
- 19 = Baking Pan

FIGURE 7.6 (cont.)

WARES (cont.)

20 = Hinges
21 = Pipe
22 = Hooks
23 = Beer Bottle
24 = Tobacco Can
25 = Cola Bottle

FIGURE 7.7
LIST OF FEATURES FOR THE HISTORIC SITES

Historic Analysis: Data Coding Format
Card 1 - Artifact Variables and Site Attributes

0 = Absent
1 = Present

Column 48
Artifact Scatter

Column 49
Blank

Column 50
Standing structure

Column 51
Blank

Column 52
Residential foundations

Column 53
Blank

Column 54
Cellar

Column 55
Blank

Column 56
Barn

Column 57
Blank

Column 58
Garage

Column 59
Blank

Column 60
Privy

Column 61
Blank

Column 62
Outbuildings

Column 63
Blank

Column 64
Dam

Column 65
Blank

Column 66
Waterhole or trough

Column 67
Blank

Column 68
Cistern

Column 69
Blank

Column 70
Well

Column 71
Blank

Column 72
Machine pad

Column 73
Blank

Column 74
Other features

Column 75
Blank

Column 76
Corral

Column 77
Blank

Column 78
Fence

FIGURE 7.8
LIST OF HISTORIC ARTIFACT VARIABLES AND SITE ATTRIBUTES

Historic Analysis: Data Coding Format
Data Record Number One

Column 1-5
Site number (i.e. JM001)

Column 6
Blank

Column 7-9
Artifact number (1-100 only)

Column 10
Blank

Column 11
Card number (1)

Column 12
Blank

Column 13-14
Artifact Group
(see Figure 6.4)

Column 15
Blank

Column 16-17
Artifact Class
(see Figure 6.4)

Column 18
Blank

Column 19-20
Artifact Type
(see Figure 6.4)

Column 21
Blank

Column 22-23
Artifact Ware
(see Figure 6.4)

Column 24
Blank

Column 25-26
Site Fuction
01 - Farmstead
02 - Town
03 - Ranch Related
04 - Trash Scatter

Column 27
Blank

Column 28-29
Location
01 - North side of Arkansas
02 - South side of Arkansas

Column 30
Blank

Column 31-32
Site components
01 - Single component
02 - Multi component

Column 33
Blank

Column 34-35
SCS Range Site Classification
(Use range site number)

Column 36
Blank

Column 37-42
Distance to permanent water
(in meters)

Column 43
Blank

Column 44-46
Total number of artifacts (0-100)

Column 47
Blank

Column 48-78
Site features
(see Figure 6.5)

FIGURE 7.9
LIST OF HISTORIC SETTLEMENT PATTERNS AND CODE NUMBERS

Historic Analysis: Data Coding Format
Data Record Number Two

Column 1-5
Site number
(example JM001)

Column 6-10
Blank

Column 11
Card number (2)

Column 12
Blank

Column 13-16
Decade: 1880s
1890s
1900s
1910s
1920s
1930s

Column 17
Blank

Column 18-19
Number of times sold
(by decade)

Column 20
Blank

Column 21
Ownership (by decade)
1 = within Bent County
2 = outside Bent, within state of Colorado
3 = outside state

Column 22
Blank

Column 23-27
Size of land holding
(in acres, by decade)

Column 28
Blank

Column 29-33
Assessed value of the land
(in dollars, by decade)

Column 34
Blank

Column 35-36
Longest time held by one family
(in years, constant)

Column 37
Blank

Column 38-41
Year of patent
(constant)

FIGURE 7.10
LIST OF HISTORIC DEMOGRAPHIC TRENDS AND CODE NUMBERS

Historic Analysis: Data Coding Format
Data Record Number Three

Column 1-6
Town:
- Animas
- Caddoa

Column 7-10
Date-
- 1880
- 1900

Column 11
Card number
(3)

Column 12
Blank

Column 13-14
Sex/Marital Status (for adults, age 16 or older)
- 01 = Single male, no family listed
- 02 = Single male, lives with parents
- 03 = Single male, head of household
- 04 = Married male, no family listed
- 05 = Married male, head of household
- 06 = Single female, no family listed
- 07 = Single female, lives with parents
- 08 = Single female, head of household
- 09 = Married female, no family listed
- 10 = Married female, not head of house

Column 15
Blank

Column 16-17
Number of children (for adult, head of household)
- 00 = no children listed
- 01-10 (etc.) number of children

Column 18
Blank

Column 19-20
Age (for adults only)

Column 21
Blank

Column 22-23
Ethnic background (for adults)
- 01 = White
- 02 = Black
- 03 = Hispanic

Column 24
Blank

Column 25-26
Place of Origin (for adults)
- 00 = Unknown/unidentified
- 01 = Alabama
- 02 = Arizona
- 03 = Arkansas
- 04 = California
- 05 = Colorado
- 06 = Connecticut
- 07 = Delaware
- 08 = Florida
- 09 = Georgia
- 10 = Idaho
- 11 = Illinois
- 12 = Indiana
- 13 = Iowa
- 14 = Kansas
- 15 = Kentucky
- 16 - Louisiana
- 17 = Maine
- 18 = Maryland

Column 25-26 (cont.)
Place of Origin

19 = Massachusetts
20 = Michigan
21 = Minnesota
22 = Mississippi
23 = Missouri
24 = Montana
25 = Nebraska
26 = Nevada
27 = New Hampshire
28 = New Jersey
29 = New Mexico
30 = New York
31 = North Carolina
32 = North Dakota
33 = Ohio
34 = Oklahoma
35 = Oregon
36 = Pennsylvania
37 = Rhode Island
38 = South Carolina
39 = South Dakota
40 = Tennessee
41 = Texas
42 = Utah
43 = Vermont
44 = Virginia
45 = Washington
46 = West Virginia
47 = Wisconsin
48 = Wyoming
49 = Alaska
50 = Hawaii
51 = Canada
52 = Mexico
53 = England
54 = Ireland
55 = France
56 = Germany

Column 27
Blank

Column 28-29
Occupation (for adults)

00 = unemployed or unlisted
01 = house wife
02 = seamstress
03 = washer woman
04 = day laborer
05 = farm laborer
06 = farmer
07 = stock grower (rancher)
08 = cattle herder
09 = sheep herder
10 = railroad section hand
11 = railroad section foreman
12 = railroad agent
13 - railroad contractor
14 = engineer
15 = blacksmith
16 = machinist
17 = wheelwright
18 = carpenter
19 = teamster
20 = stone cutter
21 = telegraph operator
22 = cook
23 = tanner
24 = teacher
25 = merchant
26 = grocer
27 = saloon keeper
28 = brewer
29 = Miscellaneous

Column 30
Blank

Column 31-32
N = total adult population

The computer programs for these three sets of data (site attributes and artifact variables, settlement patterns, and demographic trends) were designed as models to test the hypotheses presented in Section 7.3.2. The results of this analysis will be discussed in Section 9.0.

7.4 SUMMARY

The Historic Research Design addresses the data collected from both archival records and archeological information recorded from cultural properties located in the project area. The collection of this data made use of both historical and archeological methods. This included a literature search of both primary and secondary archival documents, and the organization of this information around thematic and topic lines. The broad regional data was presented as the Historic Overview, which outlined the important events and trends in the area. Site specific data was also collected, to be used in the interpretation and evaluation of historic archeological sites recorded during the survey. The site-specific information was also used to address research questions.

In order to deal with the data in a meaningful manner, a series of regional research questions were developed. The purpose of the research questions were to provide a focus for the analysis of data. In addition, specific research topics which dealt with the site specific information collected from the John Martin historic sites were formulated. A series of testable hypotheses, addressing both settlement patterns and demographic trends, were drawn up. Next, an outline for the quantitative analysis and testing of these hypotheses were developed. The results of these analyses will be presented in a later section. Qualitative information will then be examined in a narrative fashion to produce humanistic conclusions about the historical and archeological record.

SECTION 8.0
DESCRIPTION OF THE HISTORIC SURVEY DATA

by Paul D. Friedman

Because of the differences in the nature of the data, the historic sites were treated differently than the prehistoric sites. This section describes the historic survey data in narrative form. Each site recorded during the survey was researched, and a site specific history was written. This section presents a short description of each site, and its individual history.

This section will also outline the archeological methods used to collect the information about the historic sites. It will give the results of the literature search, and present the individual site histories. This site-specific data will then be analyzed in the following section (9.0) using quantitative methods in order to address the research questions presented in the preceding section (7.0).

8.1 FIELD METHODS

The fieldwork for the historic sites located during the John Martin Reservoir Project combined archeological methods with historical or archival research.

8.1.1 ARCHEOLOGICAL METHODS

The archeological methods for the historic sites were the same as those employed in the prehistory research design (Section 5.4).

8.1.2 ARCHIVAL RESEARCH METHODS

The historical research was conducted in two phases. The first phase was basically a literature search. Important sources were found at the Colorado Preservation Office and the Stephan H. Hart Library at the State Historical Society at the Heritage Center in Denver, the Western History Department of the Denver Public Library, the Western History Department in Norlin Library at the University of Colorado, Boulder campus, and the local branch of the National Archives at the Denver Federal Center. Not overlooked were local sources of information, such as the Kit Carson Historical Museum in Las Animas and the Las Animas Public Library. Scholarly secondary materials were reviewed and a historical narrative for the project area was written. The Historical Regional Overview (Section 7.1) represents the results of this effort.

The second phase of the historical research was the site-specific documentation. The chain of title for land ownership for each historic site was researched, and individual site histories written. This task stressed primary sources, mainly the public records found in the Bent County Courthouse in Las Animas. Federal patents, deeds, and tract maps provided data about periods of occupation, land tenure, and ownership. County assessment rolls contained information about personal wealth and land use.

Federal records also were useful. The United States Population Census, available from the National Archives in microfilm for the years 1900 and prior, contained detailed information about the population of this region.

Other sources consulted during the archival research stage of this project included conversations with local informants, the examination of manuscripts, collections, newspaper articles, local histories, and local business directories.

8.2 RESULTS OF THE SITE FILES SEARCH

According to the files in the Colorado Preservation Office only seven historic sites have

been previously identified within the boundaries of the John Martin Reservoir Project Area. These sites are as follows:

Site 06/01/0001 - The Fort Lyon VA Hospital Grounds and Cemetery

Fort Lyon was originally founded in 1860 as Fort Wise near the location of Bent's New Fort along the Arkansas River. After the original site was undermined by a flood in 1866 the troops were moved to the present location of Fort Lyon. This site was abandoned as a military fortification in 1889. In 1906 the fort was taken over by the Navy and used as a tuberculosis sanitarium. It served that purpose for 15 years, then was turned over to the U.S. Public Health Service. In 1929 the Veterans Bureau (now the Veterans Administration) acquired the property and converted it to a neuropsychiatric facility, a function it still serves today.

Site 06/01/0007 - The Barton and Sanderson Stage Line Route

The last of the transcontinental stage lines, Barlow and Sanderson was the final stagecoach carrier of overland mail to California. In 1872 their route connected the railhead at Kit Carson with Santa Fe, using Old Las Animas as a transfer point and depot. After the railroads were built to West Las Animas, the town became the point from which the stage line ran to Santa Fe.

Site 06/01/0010 - The Third Fremont Expedition Route

The supposed purpose of Fremont's Third Western Expedition was to explore the Arkansas in the vicinity of Bent's Old Fort. Fremont led his men along the Santa Fe Trail, arriving at Bent's Fort on August 2, 1845. From there Fremont decided on a broader interpretation of his orders and divided his party into two groups. One, under the command of Lt. J. W. Abert, was sent up the Purgatoire to survey the Red River. Fremont led the rest of the group to California, where they played a major role in the Bear Flag Rebellion and, subsequently, the Mexican-American War.

Site 06/01/0011 - The Santa Fe Trail

This trade route, first opened in 1821, connected Franklin, Missouri with Santa Fe, New Mexico. It was a key road in the settlement of the west, and many famous explorers traveled along it. There were two main forks to the trail. One crossed the Cimarron Desert, and was known as the Cimarron Cut-off, while the other continued up the Arkansas River, past Bent's Fort and over Raton Pass. The latter route, known as the Mountain Branch, went directly through the project area on the north side of the Arkansas River.

Site 06/02/0004 - The Long Expedition Route

In 1920 Major Stephen H. Long lead a military expedition from the Missouri River to explore the Rocky Mountains. The group traveled up the Platte River, and then turned south along the Front Range of the Rockies to the Arkansas River. One member of the party, Dr. Edwin James, is credited as the first white man to scale Pike's Peak. While on the Arkansas, Long split up the expedition. He lead part of the group to the Canadian River, while Captain John Bell was in charge of leading the rest down the Arkansas River, through the project area.

Site 06/02/0005 - The Pike Expedition Route

After the Louisiana Purchase, Lt. Zebulon Pike was assigned to survey the southeastern boundary of the acquisition. He traveled up the Arkansas River, along its south bank, through the project area to the Rocky Mountains. Pike is generally credited as the first American to view the region. The Spanish felt that Pike invaded

their territory. His party was arrested and escorted through Mexico back to the United States.

Site 06/02/0006 - The Gunnison Expedition Route

In 1853 Captain John W. Gunnison of the U. S. Army Topographical Engineers was assigned to survey a central route for a transcontinental railroad. Gunnison took his men along the Santa Fe Trail, along the Arkansas River, to the Rocky Mountains. They crossed the Continental Divide, and journeyed across the West Slope to the Colorado River. Making their way into Utah, the party was attacked by hostile Indians and Gunnison was killed.

These seven historic sites have all been discussed at some length in the Historic Regional Overview (Section 7.1) of this report.

8.3 SITE-SPECIFIC INVESTIGATIONS

During the field portion of the John Martin Reservoir Project, 34 sites were located which contained historic components (Figure 8.13). Twelve of the historic sites were multi-component; that is historic features or artifacts were found in association with prehistoric remains. Of the 34 historic sites, 18 were farmsteads. This functional grouping includes farms and ranches with evidence of domestic habitation. Within the farmstead category, two standing houses were recorded. Five sites contained ranch-related remains. This category included such features as fences, water troughs, or dams, but no residential features were evident. Ten sites were merely trash scatters. These sites contained historic artifacts but no features and no evidence of domestic habitation. One townsite, Old Las Animas, was recorded.

It is important to note what kinds of sites were not found during the survey. No evidence could be found of early Hispanic exploration or settlement. Even more startling, no evidence of the Santa Fe Trail was found on the ground. The route of the Santa Fe Trail is traced on the USGS (1953/photo revised 1979) topographical maps for the survey area. The trail can also be clearly seen in the new (November 1980) aerial photographs taken for the U.S. Army Corps of Engineers, Albuquerque District, covering the project area. However, although the supposed route of the Santa Fe Trail was crossed many times by our crews, no remnants of it, such as the deep ruts which can be seen in places in New Mexico, were located in the John Martin Reservoir project area. The only site which might date back to the fur-trade era is JM018. This appears to be a Native American campsite, but contained pieces of a wine bottle which may have been manufactured as early as the 1840s.

There were also some known historic sites which could not be found during the fieldwork because they lie beneath the waters of the John Martin Reservoir. For example, the original 1870 survey of Bent County by George Hill showed 13 ranches located within the project area. Twelve of these ranches were on the south side of the Arkansas River, in Township 23 South, Range 50 West. Only the Gageby Ranch was located on the north side of the river. All of these sites were either situated along the wagon road, or near the river. These ranches could not be recorded during the survey because they have been covered by the water in the reservoir. Also covered by water is the original location of the town of Caddoa. This settlement was situated in the SE¼ of Section 12, T.23S.,R.50W. Founded in 1888, Caddoa was abandoned when the dam was built in the 1940s, and the U.S. Army Corps of Engineers removed some of the buildings to a new location in the SE¼ of Section 8, T.23S.,R.49W.

This section of the report will detail the remains of historic sites located and recorded during the cultural resources survey of the John

FIGU
HISTORIC SIT
JOHN MARTIN RES

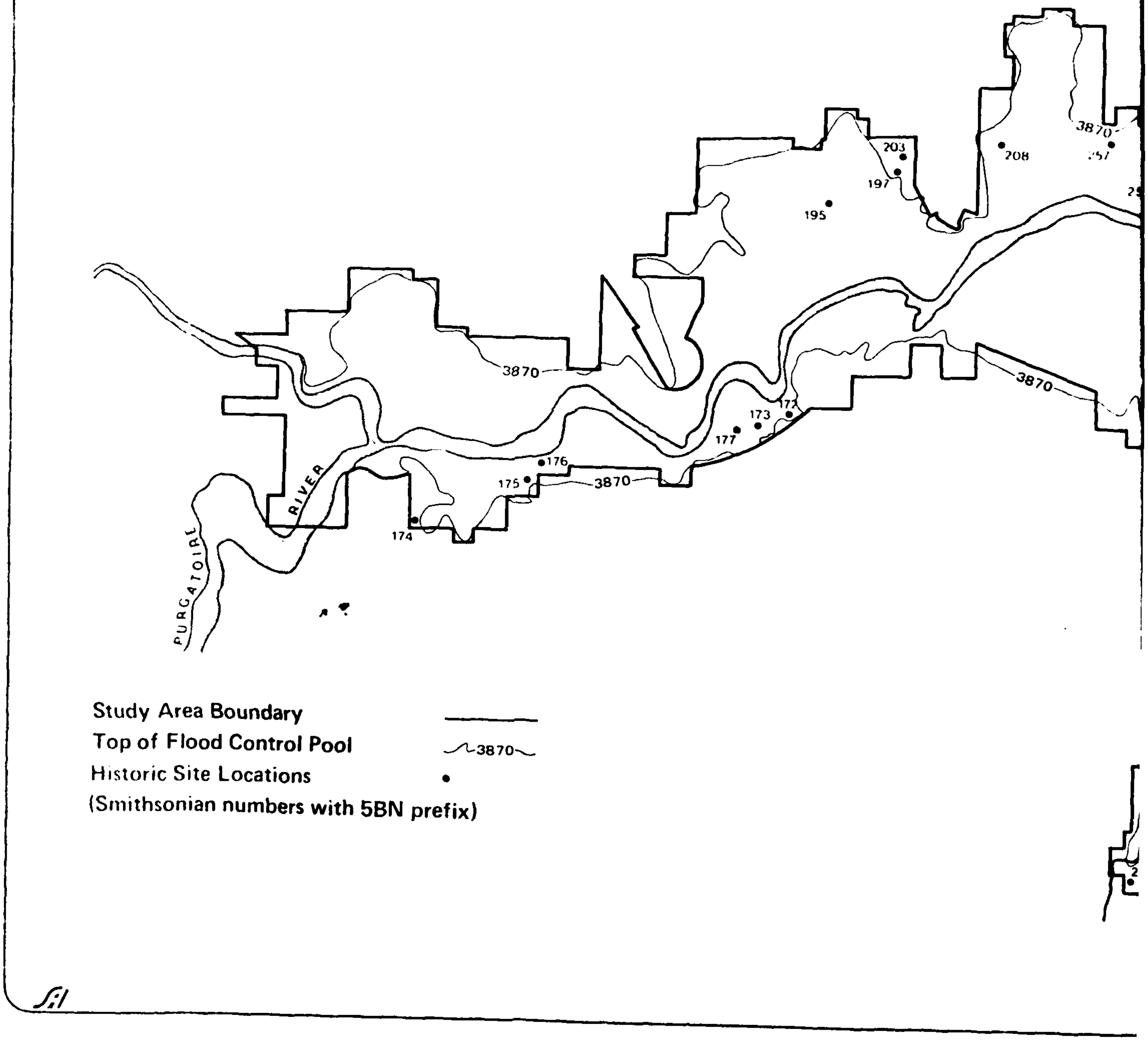
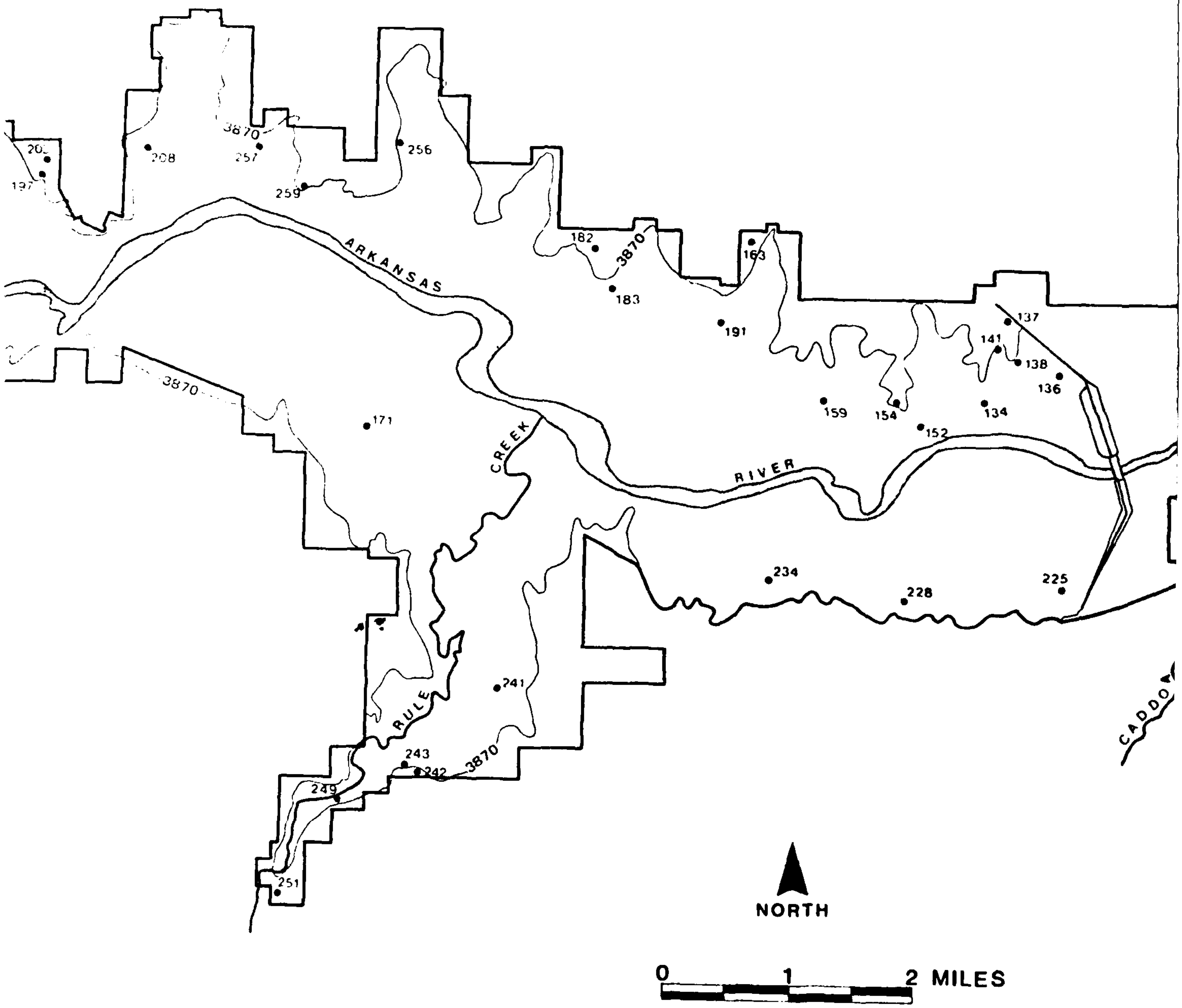
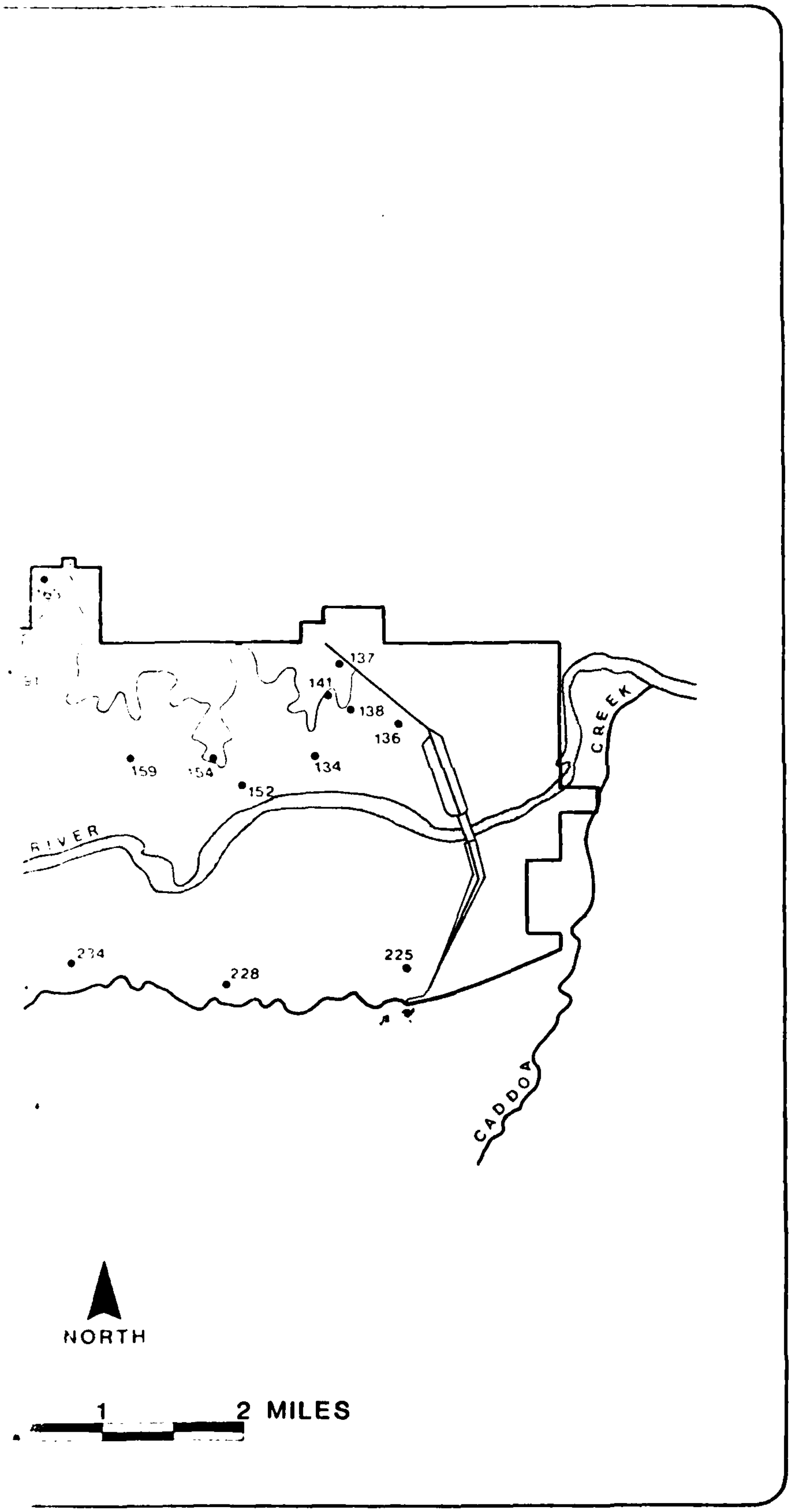


FIGURE 8.1
HISTORIC SITE LOCATIONS
JOHN MARTIN RESERVOIR PROJECT




137
141
138
136
159
154
134
152
RIVER
CREEK
234
228
225
CADDOA
NORTH
1
2 MILES

Martin Reservoir project area. It will discuss the physical location of each site, its features, function, chronology, and artifactual assemblage. Each site will have a history written for it. These histories represent the information uncovered during the site-specific research phase of the project. They mainly pertain to changes in ownership of the tract of land which contains the site.

JM001/5BN136 (Farmstead)

Site JM001 is located in the SE¼ of NW¼ of Section 6, T.23S, R.49W. It is southwest of the airfield. The main feature at this site was the remains of a rectangular sandstone foundation. The walls of the structure were of cut stone and varied in thickness between two and four courses. The west wall foundation was intact, but the other walls had collapsed inward. The approximate dimensions of the structure were 10.5 m by 4.0 m. Two possible entrances existed along the eastern face. Eleven artifacts were found and recorded in the vicinity of the structure, including galvanized roofing tin, barbed wire, metal barrels, and automobile parts. It has been suggested that this structure may have served as some kind of a storage shed. It may also have been a residence.

Site History

Historical research has shown that this site is probably related to the Siglea homestead. Harry D. Siglea received a federal patent according to the Homestead Act of 1862 for 137 acres located in the S½ of NE¼, SE¼ of NW¼, and Lot 8 of Section 6, T.23S, R.49W, on September 2, 1919 (Bent County, *U.S. Patent Record*, Book 105: 122). The Bent County Assessment Roll for 1920 showed that Siglea used the property as grazing land, although no livestock was listed. The 1920 tax roll listed his mailing address as Hasty, but the 1930 list showed that he lived in Caddoa. As was typical for the region in general, Siglea signed several gas and oil leases for his property during the 1920s. However, nothing came of these leases. Siglea must have joined with other landowners within the project area to contest the price the federal government offered him for his land when the United States began to acquire the land for the dam and reservoir. The case was settled in court, and the United States paid Siglea $1,708 for his land (Bent County, *Miscellaneous Real Estate Record,* Book 210:88). Siglea quit claimed his property to the federal government on January 26, 1942.

JM002/5BN137 (Trash Scatter)

JM002 is located in the NW¼ of NW¼ of Section 6, T.23S, R.49W. This site is a trash dump which extends for over 600 m along the northern embankment of the bluff above the marshy area just to the west of the airstrip. Most of the artifacts in the trash scatter appear to date to the early decades of the twentieth century, mainly from the 1930s. At the bottom of the slope, at the south end of the site, is the remains of a wooden structure. Scattered on the bottom of the slope in the marshy area along the extent of the site are various pieces of construction materials, such as blocks of cement and brick.

The origin of this site can be guessed from a close examination of various maps. The 1940 Reservoir Topographical Map drawn by the U.S. Army Corps of Engineers showed the area around JM002 extended from an elevation of 3,850 feet to 3,880 feet. The current USGS topographic map (1953/photorevised 1979) shows that this same area now is a depression which falls from 3,885 feet in elevation to 3,855 feet. This fact was explained by one of the resident engineers at the dam who told us that this area was used as a "borrow pit" dring the construction of the dam in the 1940s. After the borrow pit was dug the depression evidently became a dumping ground. The wooden structure and construction materials at the bottom of the depression were obviously dumped there after the dam had been built and

are not to be considered evidence of residential occupation at this site.

Site History

Although the history of the ownership of this site has no bearing on the features or artifacts found there, it is interesting to explain it as part of the history of settlement for this region in general. The 154-acre tract containing JM002 was patented by Mira H. Beebe on April 21, 1890 (Bent County, *Patent Record,* Book 14:474). Mira Beebe married Charles K. Davis and they lived in Caddoa. The 1910 Bent County Assessment Roll showed that 80 acres of the Davis' land was used for agricultural purposes while 74 acres was used for grazing. On April 28, 1914 Mira Beebe Davis sold the property to Carl Trostel (Bent County, *Warranty Deeds,* Book 70:522).

The Trostels were an important family in this region. The three Trostel brothers, George, Fred, and Carl, came out to Bent County from Des Moines, Iowa. They began to buy land and put together a Hereford cattle ranch. The center of their enterprise was the old John Prowers ranch. The Trostels also played a major role in the economy of Caddoa, owning many of the lots in town and operating a lumberyard and hardware store there. Fred Trostel married Helen Cogswell, who later wrote a fictious account of the activities surrounding the construction of the John Martin Dam and Reservoir. (Mrs. Dorothy Boyd 12 August 1980: personal communication; Mr. Harold Sorenson 12 August 1980: personal communication).

On July 31, 1914, Carl Trostel sold the tract of land containing JM002 to the Caddoa Land and Investment Company (Bent County, *Deeds,* Book 70:531). This company was controlled by the Trostels and used for business purposes. On June 4, 1923, the Caddoa Land and Investment Company sold the land back to the Trostels (Bent County, *Trust Deeds and Miscellaneous Records,* Book 68:173). The 1920 Bent County Assessment Roll indicated that 100 acres of the 154 acre tract containing site JM002 was irrigated farmland while the rest of the property was used for grazing. The Bent County Assessor's Notebook for 1929 showed that the "Trostel Bros." owned 3,154 acres assessed at $31,300 with $2,000 worth of improvements. The fact that they used the ranch to mainly raise cattle is reinforced by the listing of their livestock: 4 horses, 3 mules, and 275 head of cattle. The Trostels sold a large part of their property to the United States when the dam was built, including the tract which contained JM002, on November 15, 1941 (Bent County, *Miscellaneous Real Estate,* Book 207:522).

JM003/5BN138 (Trash Scatter)

Site JM003 is located NE¼ of NE¼ of Section 1, T.23S,R.50W. It is just to the west of a dirt road which leads down to the reservoir. The site consists of three small concentrations of artifactual material, mainly domestic in nature. The artifacts included tin cans, bottle glass, and salt-glazed stoneware. The artifacts appear to date from about 1880 to 1930 according to observed manufacturing techniques and maker's marks. One brown glass bottle neck from a whiskey bottle was finished with a lipping tool. Other glass bottle necks showed that they were molded and had crown caps. The brown glass bottle base which was collected from this site had the marker's mark "W F & S, MIL" on it. This bottle was manufactured between 1900 and 1929 by William Franzen & Sons, Milwaukee, Wisconsin (Toulouse 1971: 536).

Again, the key to understanding this site came from an examination of relevant maps. The 1940 Reservoir Topographical Map prepared by the COE showed that the road next to which this site is located was the main road into the town of Caddoa from the north. The trash scatter is probably related to the use of

this road. The dates for the artifacts closely correspond to the dates for the occupation of the town.

Site History

This is another case where the chain of title for the piece of property containing the site has little or no bearing on the features or artifacts found there. But the history of the ownership of this property does shed some light on regional settlement patterns and land use. The site is part of a 160 acre tract that was patented by Willis V. Taylor on December 16, 1918 (Bent County, *U.S. Patent Record*, Book 130:30). Willis V. Taylor, a stone mason who lived in the town of Caddoa, died on July 9, 1922. His widow, Ella Florance Taylor inherited half the estate, and the other half was divided among his six daughters. The probate records listed only one cow as his personal property. Like other property owners in the area, Mrs. Taylor entered into several oil and gas leases in the 1920s, but the leases were later released. The property stayed in the hands of the Taylor family until it was acquired by the United States on March 28, 1940 for $1,200 (Bent County, *Warranty Deeds,* Book 203:167).

JM004/5BN139 (Trash Scatter)

This site is located in the SE¼ of NE¼ of Section 1, T.23S,R.50W. JM004 was found at the edge of the reservoir, below the high-water mark. It consisted of a scattered deposit of domestic artifacts. The artifacts appear to date mainly from the 1920s and 1930s although there was a significant amount of more modern material there as well. The scatter included, machine-made soda bottles, "Homer Laughlin" ceramics, so-called "Depression glass," and ceramics made with "decalomania" motifs. It does not appear that these artifacts were deposited here due to human occupation or activity. One explanation for their presence is that they are the domestic leftovers from the town of Caddoa, located underwater directly south of the site, and that wave action from the reservoir has washed them up on the shore.

Site History

This site was once part of the Taylor tract and has the same chain-of-title as JM003.

JM006/5BN141 (Trash Scatter)

This is a multi component site located in the NE¼ of NE¼ of Section 1, T.23S.,R.50W. The site is found just to the south of the Santa Fe Trail marker, in an area surrounded by elm trees and an irrigation ditch. The Native-American component of this site shows possible evidence of Euro-American contact. Pieces of purple glass were found which appear to have been worked, having retouched edges. The Euro-American component at this site is a small trash concentration of fragments of purple bottle glass and tin cans. Because of the site's location next to the Santa Fe Trail marker and the arrangement of the elm trees, it has been suggested that perhaps this area functioned as a park. That would explain the presence of the Euro-American historic artifacts. There were no historic residential features found in this area.

Site History

This site has the same chain-of-title as JM003 and JM004, being once part of the Taylor tract. See JM003 for this history.

JM018/5BN152 (Trash Scatter)

This site is located in the NE¼ of SW¼ of Section 1, T.23S,R.50W. It is on the road leading down to a picnic area above the resevoir. JM018 is a multi component site, mainly consisting of a prehistoric lithic scatter. However, several pieces of green bottle glass were found. This glass

appears to come from one vessel. The bottle base has a prominent kick-up, 57.2 mm in height. The style of the kick-up and the thickness of the glass seem to indicate that this was a French Champagne bottle from the nineteenth century. One expert thought it might date back as far as the 1840s (Richard Carrillo: pers. comm. (See Figure 8.2) This is the only historic site located during the survey which might be dated to the period of the fur trade. It has been suggested that the site was somehow associated with the use of the Santa Fe Trail. This famous highway is located 1-km north of the site.

Site History

Like most of the trash scatters found during the survey, the chain-of-title for the property sheds almost no light on the activities which resulted in the discard of artifacts at this location. However, the history of landownership does contribute to knowledge about regional settlement patterns and land use. The parcel which contains site JM018 was a 154-acre tract patented on February 13, 1922 by Nettie L. Trostel (Bent County, *U.S. Patent Record,* Book 105:583). The patent indicated that she was formerly known as Nettie L. Baldwin, showing that she was related to two of the most important landowning families in the area, the Trostels and the Baldwins. Nettie L. Trostel held on to this land for the next 18 years. The 1930 Bent County Assessment Roll showed that she had increased the size of her land holdings to 300 acres, which was used for grazing purposes. Like other landowners in the area, she signed a lease for the oil and gas rights to her property, but nothing came of this. On June 8, 1940 Nettie Trostel sold her land containing this site to the United States for $1,450 (Bent County *Warranty Deeds,* Book 203:221).

JM020/5BN154 (Trash Scatter)

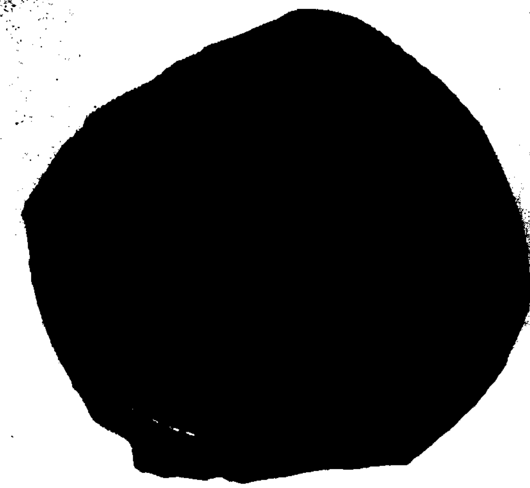
This site is located in the SW¼ of NW¼ of Section 1, T.23S.,R.50W. It is on the road leading down to a picnic area above the reservoir. The site consists of a scatter of artifacts of very recent origin. Included in the artifact scatter was a Colorado motor vehicle license plate, an orange fiesta-ware bowl, a Dr. Pepper soda bottle, a rusted metal toy truck, and a brown glass bleach bottle. It is suspected that this trash scatter is related to the recent use of the picnic ground.

Site History

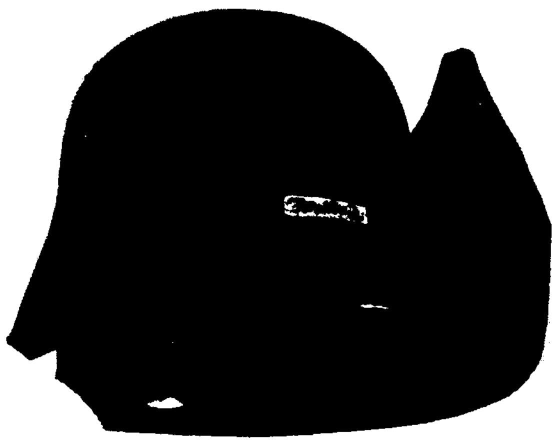
Richard F. Klett received a federal patent for the 137 acre tract containing site JM020 on May 17, 1909 (Bent County, *U.S. Patent Record,* Book 14:538). On June 4, 1917 Richard F. Klett conveyed about 2,000 acres of land to his son, Richard H. Klett, including the tract which contained site JM020. The deed specified that the transaction included land, "Together with all cattle branded K on left hip or thigh and all horses branded on K on left hip or thigh, and all chickens, farm machinery, and other personal property and chattels located upon above land and used in the conduct and operation of the same as a ranch or farm." It also stipulated that Richard H. Klett must keep a full written account of the operation of the ranch, and could not sell land or livestock or create liens against the property without the consent of his father (Bent County, *Miscellaneous Record,* Book 97:283). A closer look at the use of this land, through the Bent County Assessment Rolls, shows that it was primarily a livestock ranch. In 1920 Richard Klett owned 3,021 acres of land in Bent County, only 60 of which was used for farming purposes, the rest used for grazing. The 1919 Assessor's Notebook indicated that Klett had 16 horses, 4 mules, and 255 head of cattle on his ranch.

The Klett ranch headquarters was located on the north side of the Arkansas River, just west of the Caddoa bridge. The Kletts were typical of the larger ranches in this project area. They would buy out smaller homesteads to increase

FIGURE 8.2
HISTORIC ARTIFACT SITE JM18
JOHN MARTIN RESERVOIR PROJECT



A. Wine bottle base.



B. Wine bottle base (notice height of the kick-up).

0 2 cm

the size of their landholdings. According to one informant, the Klett family first came to the project area in the 1870s (Dorothy Boyd August 12, 1980: personal communication). However, local assessor's tract maps show that Richard Klett acquired Indian Claims 17 and 18, the center of his ranch, sometime between 1899 and 1904.

On April 19, 1926, Richard H. Klett quit claimed all his property to his wife, Flora A. Klett (Bent County, *Miscellaneous Record,* Book 154:264). By 1930 the ranch had grown to well over 5,000 acres. Because their land was located next to the Arkansas River they were able to irrigate it easily. Although raising livestock continued to be an important part of the operation of the ranch, the Kletts' increased their size of their agricultural land to 2,280 acres. The rest of the ranch, over 3,000 acres was used for grazing (Bent County *Assessment Roll* 1930). The 1929 Bent County Assessor's Notebook showed that Richard F. Klett had 7 mules, 10 horses, and 615 head of cattle. Like many landowners in the project area, the Kletts signed oil and gas leases for exploration of their property in the 1920s, but these leases were later released. When the United States began to acquire land for the John Martin Dam and Reservoir they had to take some landowners to court to settle the purchase price for the property. In the District Court case of *USA vs Keesee Water and Land Company, et. al.* Richard H. and Flora Klett were awarded a settlement of $54,890 for their land (Bent County, *Decree Record*, Book 199: 472). The property was quit claimed by the Kletts to the United States on November 15, 1941 (Bent County, *Real Estate Record*, Book 207:520).

JM025/5BN159 (Trash Scatter)

This site is located in the SE¼ of NW¼ of Section 2, T.23S.,R.50W. It is a multicomponent site, mainly consisting of a prehistoric lithic scatter. The historic component at JM025 consists of several pieces of broken crockery of what looks like a water jug.

Site History

The 160-acre tract which includes site JM025 was filed on by William B. Dunan on January 19, 1883 at the U.S. Land Office in Pueblo (Bent County, *Deeds,* Book 1:483). On August 25, 1883, Dunan sold the property to George Hill for $300 (Bent County *Abstract Book,* No. 5:82). Hill then sold the land to J. H. Jay on February 13, 1893 for $800 (Bent County, *Abstract Book,* 5:82). On December 11, 1891 John H. Jay sold several pieces of property for $6,865, including the tract which contained site JM025, to George Salisbury (Bent County, *Warranty Deeds,* Book 25:443). Salisbury sold the property for $8,000 to the Central National Bank of Pueblo on September 26, 1893 (Bent County, *Warranty Deeds,* Book 25:566). On January 29, 1898 the Central National Bank of Pueblo conveyed the property to the Western National Bank of Pueblo (Bent County, *Trust Deed Record,* Book 31:36). In July 1901 the Western National Bank of Pueblo sold the 149-acre tract containing site JM025, described as Lots 5 and 6 of the NW¼, Lot 7 of the SW¼, and Lots 8 and 9 of the SE¼ of Section 2, T.23S., R.50W., to Richard F. Klett of $100 (Bent County, *Warranty Deeds,* Book 46:267). Thus this land became part of the Klett ranch. The rest of the chain-of-title for the tract containing JM025 is the same as JM020. Richard F. Klett deeded it to his son, Richard H. Klett, in 1917, and his son gave it to his wife, Flora A. Klett, in 1926. The United States acquired the property in 1941.

JM029/5BN163 (Farmstead)

This site is located in the NW¼ of the SW¼ of Section 35, T.22S.,R.50W. JM029 is situated on a slight rise above a drainage for an inter-

mittent stream. The site includes the stone foundation of a main residence with a concrete celler, the remains of at least three outbuildings, a cistern, a concrete machine mount, an associated trash scatter, and a waterhole located about 150 m to the southwest. The artifact scatter was domestic in nature and included mason jars, earthenware crocks, ironstone ceramics, purple glass fragments, green glass, tin cans, and bricks, to name just a few of the categories present. This was one of the most substantial rural/domestic residences found during the survey.

Site History

JM029 appears to be the old Baldwin homestead. Charles B. Baldwin acquired a federal patent for the 160 acres described as the SW¼ of Section 35, T.22S.,R.50W. on January 13, 1906 (Bent County, *U.S. Patent Record,* Book 14:196). On January 25, 1910 Charles Baldwin gave the property to his wife, Mary Baldwin. The deed included 144 shares of capital stock in the Fort Lyon Canal Company for the irrigation of this property (Bent County *Warranty Deeds,* Book 70:365). By that date the Baldwin family had already begun to expand their operations. The 1910 Bent County Assessment Roll listed "C. Baldwin and Sons" as owning 560 acres, 250 of which was irrigated farmland. They owned 2 mules, 2 head of cattle, and 16 horses. Also listed under personal property were 2 vehicles assessed at $30, agricultural implements worth $60, and $50 worth of household furniture. At this point it is clear that the Baldwin homestead was operated mainly as a farm.

In 1920 the Bent County Assessment Roll showed that the estate of Mary Baldwin controlled 460 acres, 200 of which was irrigated farmland. In 1922 the property passed into the hands of Delbert Baldwin, the son of Charles and Mary Baldwin, when other heirs to the estate of Mary Baldwin quit claimed the property to him. The Baldwin family probably combined this tract with other property they controlled and operated it as a single economic unit. The 1929 Bent County Assessor's Notebook showed that the "Baldwin Brothers" owned 2,897 acres of land and had 12 mules, 20 horses, and 212 head of cattle on it. The 1930 Bent County Assessment Roll indicated that the tract of land which contained JM029 was no longer used for farming. It was listed as "grazing" land, showing that the Baldwins were now primarily in the ranching business.

Although title to the property had legally transferred from Charles Baldwin, to his wife, Mary, and then to his son Delbert, it can be stated with a fair amount of certainty that it was Charles who occupied the house at JM029. The deed giving the land to Delbert Baldwin on March 10, 1922 included the stipulation that "Charles B. Baldwin, surviving husband of Mary R. Baldwin, deceased, shall have the use and occupancy of the said premises, together with all the rents issues and profits thereof, for the rest of his natural life, and free of all expense whatsoever on the part of said Charles B. Baldwin" (Bent County, *Miscellaneous Real Estate Record,* Book 207:535).

The Baldwin family controlled this property until it was acquired by the United States. On April 10, 1943 the United States District Court awarded the heirs of Mary R. Baldwin $2,475 for the 160 acres of the SW¼ of Section 35, T.22S.,R.50W. (Bent County, *Miscellaneous Real Estate Record,* Book 212:244).

JM037/5BN171 (Ranch Related)

This site is located in the NE¼ of NE¼ of Section 7, T.23S.,R.50W. It is situated just north of the Santa Fe Railroad tracks. The features at JM037 include a concrete water trough, sandstone rubble piles, and the remains of a structure built of cement blocks. None of the structural remains appears big enough for a residence. A concrete cistern was located about 200 m to the west. No artifacts were found

in the vicinity of this site.

Site History

The features at JM037 are probably related to the operation of the Huey ranch complex. On August 23, 1919 Charles S. Huey purchased 654 acres of federal land, including the parcel which contains JM037 (Bent County, *U.S. Patent Record,* Book 89:293). Charles Huey then sold the 654 acres to Thaddeus Huey for $1,000 on August 30, 1919 (Bent County, *Warranty Deeds,* Book 92:434).

The Bent County tax records for 1920 show that in addition to several town lots in Las Animas, Thaddeus Huey owned 860 acres of grazing land. The fact that this land was used primarily for ranching purposes is reinforced by the listing of 9 mules, 14 horses, and 279 head of cattle, owned by Huey on the tax rolls for that year. Thaddeus Huey did not live long enough to enjoy his property. After his death his estate sold 640 acres, including JM037, to Richard H. Klett on September 6, 1924 for $3,336.37 (Bent County, *Miscellaneous Record,* Book 142:110).

The rest of the chain-of-title for this tract is the same as JM020. In 1926 Klett gave the land to his wife, Flora A. Klett, and in 1941 it passed to the United States.

JM039/5BN172 (Trash Scatter)

This site is located just south of the Arkansas River in the NW¼ of NE¼ of Section 10, T.23S.,R.51W. It is a multicomponent site. The historic component consists of several pieces of brown glass, apparently from one bottle. It appears to have been a whiskey bottle, with a hand applied lip.

Site History

This site falls within the 160-acre tract described as the E½ of the NW¼ and the W½ of the NE¼ of Section 10, T.23S.,R.51W. which was patented by John Conway on January 20, 1882 (Bent County, *U.S. Patent Record,* Book 89:443). On February 7, 1888 Conway sold 480 acres, including the tract which contains JM039, to M. H. Murry for $600 (Bent County, *Warranty Deeds,* Book 1:99). Malache Murry was found listed in the 1880 U.S. manuscript population census sheets as residing in Old Las Animas. In 1880 Murry was described as a 37-year-old "Stock grower" from Pennsylvania. He was married, and had one child, a girl named Anna. For the next 32 years the Murry family controlled the land which contained this site. The 1910 Bent County Assessment Roll showed that the land was used for grazing purposes. On May 21, 1920 M. H. Murry gave the property to his wife, M[illegible]ry (Bent County, *Warranty Deeds,* Book 104:[illegible] Mary Murry then sold it to D. D. Amis on June 3, 1920 (Bent County, *Warranty Deeds,* Book 104:320).

Amis had been leasing the land from the Murrys since 1915. In 1920 Amis owned almost 900 acres of land, and the Bent County Assessment Roll indicated that he used the land containing JM039 for grazing livestock. This is confirmed by the 1920 Bent County Assessor's Notebook which lists 14 horses and 350 head of cattle among his personal property. On June 17, 1920, D.D. Amis borrowed $3,000 from John O'Connell and put up his land as collateral (Bent County, *Deed of Trust-Public Trustee,* Book 101:259). Unfortunately, Amis defaulted on his loan, and on July 21, 1922 the Public Trustee put the property up for sale. It was acquired on April 21, 1923 by John O'Connell for $3,775.34, being the highest bid for the land (Bent County, *Miscellaneous and Mortgage Deeds,* Book 132:14).

O'Connell owned 2,652 acres in Bent County. The 1930 Bent County Assessment Roll indicated that the parcel containing JM039 was used for grazing purposes. On July 10, 1931

John O'Connell gave a large part of his property, including site JM039, to Regis College and the Saint Thomas Theological Seminary (Bent County, *Miscellaneous Real Estate Record,* Book 176:447). On February 26, 1941 Regis College and the Saint Thomas Theological Seminary of Denver sold the property to the United States for $4,087.48 (Bent County, *Warranty Deeds,* Book 203:447).

JM040/5BN173 (Trash Scatter)

This site is located in the NE¼ of NW¼ of Section 10, T.23S.,R.51W. It consists of a trash dump of tin cans, glass, and ceramics. The artifacts appear to date from the late nineteenth century to the early twentieth century. This is strongly supported by the one bottle base with a marker's mark which was found. The marker's mark read "ERS & S", indicating that this bottle was manufactured by E.R. Squibb and Sons sometime after 1895 (Toulouse 1971:184). It is possible that the trash dump is somehow related to the stock-raising activities on this land. Perhaps it was a temporary cattle round-up camp where food and beverages were dispensed, and their containers discarded. However, no residential features were found in this area.

Site History

Site JM040 shares the same chain of title as JM039. See that site for further details of the history of JM040.

JM041/5BN174 (Farmstead)

JM041 is one of two standing houses located in the project area. It is situated in the SW¼ of SE¼ of Section 7, T.23S.,R.51W. The house is constructed of adobe, with stucco plastering. It has a trussed roof and a central chimney. The dimensions of the house are 10 m by 20 m, with four interior rooms. It appears that the house was altered at some date after its initial construction because there is an addition on the west side. In the back of the house, on the east side is a cooler, 1 m in depth, and a cistern. There is also a concrete patio in the back. The house is all that remains at the site, there being no outbuildings or artifacts found. There is a well and an irrigation ditch located about 50 m to the east of the house, indicating that this domestic residence was a farm. It is believed that this is the former Dobbins residence and that the house was built around 1894. The fact that the house was built of adobe bricks has led some to believe it must have been occupied by people of Hispanic descent. However, it should be pointed out that adobe was a common building material in this region, used by Hispanics and Anglo-Americans alike. Also, none of the owners of this property had a Hispanic name.

Site History

The 160-acre parcel which contains site JM041 was patented on July 9, 1894 by James S. Dobbins, being described as the SE¼ of Section 7, T.23S.,R.51W. (Bent County, *U.S. Patent Record*, Book 14:96). On January 23, 1902 James S. Dobbins gave the S½ of the SE¼ of Section 7, containing 80 acres and including JM041, to Scott W. Dobbins, perhaps his son (Bent County, *Warranty Deeds,* Book 46:356). The 1910 Bent County Assessment Roll showed that Scott Dobbins owned 240 acres of grazing land, including the parcel which contains JM041. The use of adobe in the construction of the house, a style more typical of the late nineteenth century in this region than of the twentieth century when brick was more commonly used, is one of the major factors pointing to the possibility that it was the Dobbins who built and occupied the house.

On June 23, 1913 Scott Dobbins sold all of the SE¼ of Section 7 to R. Phillips of La Junta for $100 (Bent County, *Warranty Deeds,* Book 70:338). On May 26, 1919 Rufus Phillips con-

veyed to Robert Phillips, perhaps his son, the SW¼ of SE¼ of Section 7, a 40-acre parcel containing JM041, and water rights to 15 shares of stock in the Consolidated Extension Canal Company (Bent County, *Warranty Deeds,* Book 171:41). So by this date the land was probably being used for farming, and the irrigation ditch located to the east of the house may be the one dug by the Consolidated Extension Canal Company. Robert Phillips moved to Milwaukee, Wisconsin, and on November 17, 1926 he gave the property back to Rufus Phillips, (Bent County, *Warranty Deeds,* Book 184:282). Rufus Phillips then conveyed this land to the Otero Realty Company of La Junta on December 4, 1926 (Bent County, *Warranty Deeds,* Book 148:313).

On May 7, 1929, Rufus Phillips reacquired the SE¼ of Section 7 (Bent County, *Miscellaneous Real Estate Record,* Book 166:402). Phillips then sold the W½ of the SE¼ of Section 7, containing 80 acres including JM041, and the water rights to the Consolidated Extension Canal to William L. Fischer for $8,000 (Bent County, *Warranty Deeds,* Book 171:41). The 1930 Bent County Assessment Roll clearly indicated that this land was being used for farming purposes by Fischer. On November 3, 1931, Fischer sold the property back to Rufus Phillips for $8,000 (Bent County, *Treasurer's Deeds and Public Trustee's Deeds,* Book 169:297).

On March 24, 1933, Rufus Phillips borrowed $10,900 from Otero Loan and Building Association, using his property as collateral (Bent County, *Trust Deeds and Miscellaneous, Book 181:330).* Phillips defaulted on his loan and on October 22, 1934 Otero Loan took possession of it (Bent County, *Miscellaneous Real Estate Record,* Book 186:365). At this point it can be assumed that the house was probably abandoned, although it is possible that the bank leased the property to tenent farmers. On July 3, 1940 the United States purchased the SE¼ of Section 7, together with all water rights, from Otero Saving and Loan Association for $9,032.80 (Bent County, *Warranty Deeds,* Book 203:246).

JM042/5BN175 (Farmstead)

This site is the other standing house recorded during the survey. It is situated in the NE¼ of SW¼ of Section 8 T.23S.,R.51W. The house is constructed of concrete blocks covered with stucco and has a brick facade on the front. It has a square floor plan and hip roof. The interior dimensions measure 20 m by 20 m, divided into four rooms. It was heated with a wood-burning stove. There is a cellar in the southeast corner of the house, 2 m in depth. Approximately 100 m southwest of the structure is a housing for a windmill, indicating that this property was operated as a farm. From the information gathered during the historical research, it is believed that this house was built between 1913-1914, possibly by Charles Beach.

Site History

The parcel which contains this site was originally part of the townsite of Old Las Animas (see site JM043). Long after the townsite was abandoned the property was put up for sale by the County Treasurer for failure to pay taxes due on the land for the year 1895. On November 12, 1909 Charles W. Beach acquired it for $423 (Bent County, *Tax Deeds and Release of Mortgages,* Book 58:106). Beach also acquired the interest of other claimants to the land, getting them to quit claim the property to him between 1910 and 1912. In 1913 Beach went to court to clear his title to the land, and was declared owner of the S½ of Section 8, which includes site JM042, (Bent County, *Decree Record* Book 83:297). Beach conveyed the property to Rufus Phillips on November 30, 1914 (Bent County *Quit Claim Deeds,* Book 69:187). Phillips then turned right around and sold 33½ acres in the NE¼ of the SE¼ of Section 8 to A.C. Holmes for

$2,847.50 that same month. The transaction included the water rights of 16.75 shares of stock in the Consolidated Extension Canal Company, showing that the land was irrigated.

There are several reasons why it is believed that the house was probably built between 1913-1914, perhaps by Charles Beach. In 1913 when Beach received clear title to the land, it was stated in court that the property, which contained 320 acres, was worth only $320. One year later Rufus sold 33½ acres of this tract for $2,847.50, including water rights. So in the year 1913-1914 the value of the property was greatly increased and the land had been irrigated. Phillips owned the property for less than a month, according to the county records, so it is doubtful that he made the improvements on it. On the other hand, Charles Beach lived in the town of Las Animas, not at the location JM042. One possible solution to this problem is that Beach built the house and irrigated the land with the intention of selling it at a profit. He probably involved Rufus Phillips in the deal, quit claiming the property to Phillips, and allowing Phillips to find a buyer for the tract, in the person of A. C. Holmes. This, of course, is mere speculation for the documents are unclear. Another reason it is thought that Beach built the house is the fact that Holmes only held on to the property for five years, and on August 27, 1919 he sold it back to Charles Beach (Bent County, *Warranty Deeds,* Book 92:453). The 1920 Bent County Assessment Roll showed that this property was used as farmland. Beach held on to the land until it was acquired by the United States government on October 24, 1940 (Bent County, *Quit Claim Deeds,* Book 202:101).

JM043/5BN176 (Townsite)

JM043 is the site of Old Las Animas. It was the only townsite recorded during the survey. The site is located in an area of dense brush in the S½ of the NE¼ of Section 8, T.23S.,R.51S. This site was not visible during the pedestrian transects and was located with the help of a local informant. Local collectors have known about the site for many years, and it has been extensively disturbed by bottle hunters. The features at the site consist of sandstone foundations, depressions, rubble piles, stone walls, and scattered artifacts. The range of artifact types is large, although most appear to be domestic in nature. They include tin cans, ceramics, bottle glass, window glass, nails and similar kinds of refuse. Although the artifacts described were not in themselves chronologically diagnostic, the period of occupation for this site is known from other sources, to have been from 1869 to 1887. These is also a prehistoric component at this site.

JM043 is quite large, covering an area of over 96,000 m^2. It was recorded and mapped in two stages. In the first stage, the site was investigated on foot, four datums were set, and several of the features were recorded and mapped using a Brunton compass mounted on a tripod and a 50 m tape measure. At this time various artifacts were flagged and described on the mapping form. It was decided that the site was too big and complex to finish the mapping in this manner, so another visit to the site was necessary with the proper equipment. During the second site visit a rod and transit were used for mapping purposes. Twenty-two features were recorded in this manner. It is likely that many features could not be recorded because they could not be distinguished amidst the thick, brushy ground cover. The results of the two separate visits were combined, and a map was generated for the site, showing the location of various features and structures (Figure 8.3). The site map shows that many of the features are lined up NE to SW, an alignment which orients them towards Fort Lyon. Comparing this to the original plat for Las Animas City (Figure 8.4), it can be seen that the streets for the town ran NE to SW, and were aligned towards Fort Lyon.

FIGURE 8.3
SITE MAP - JM43
JOHN MARTIN RESERVOIR PROJECT

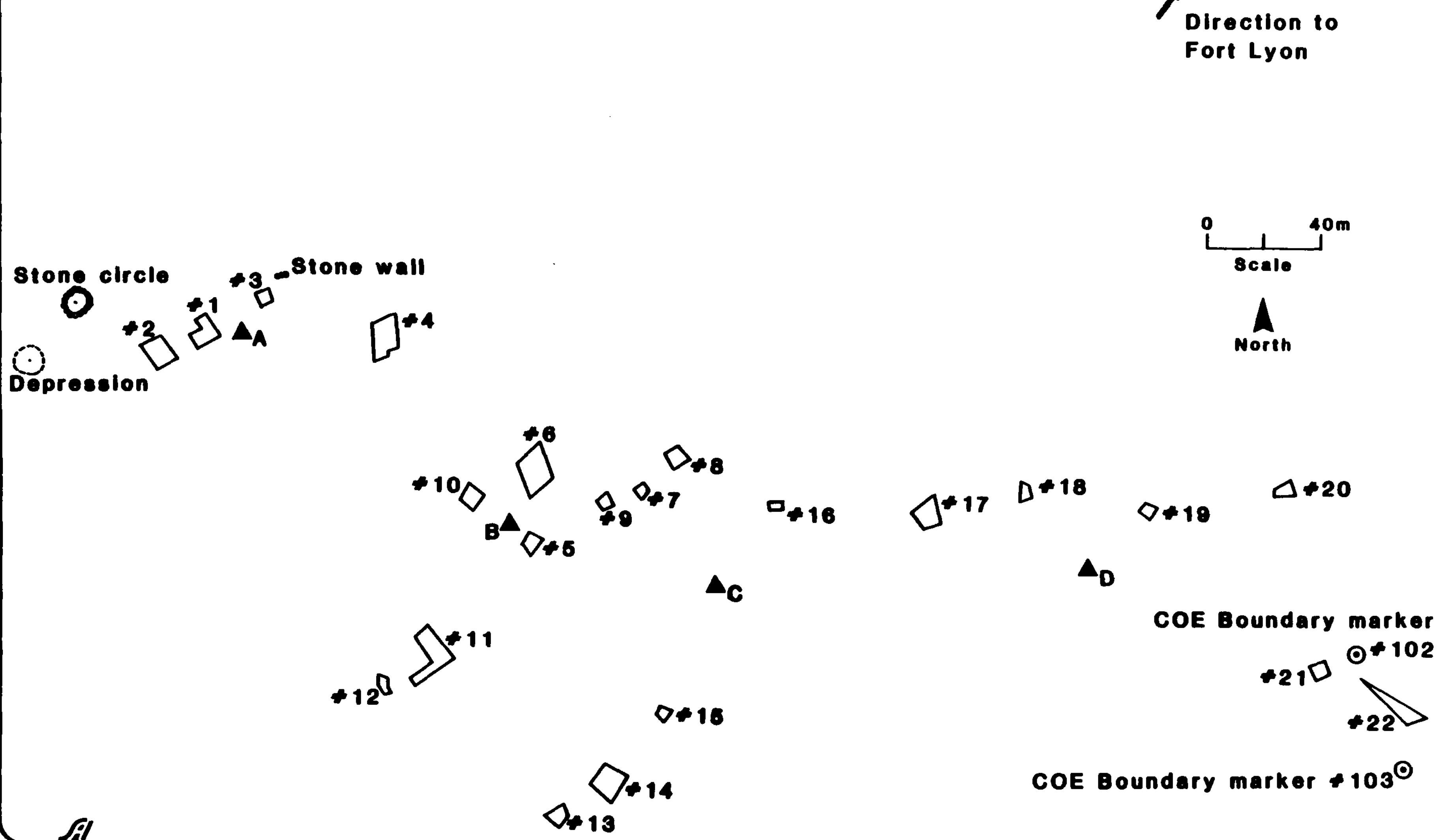
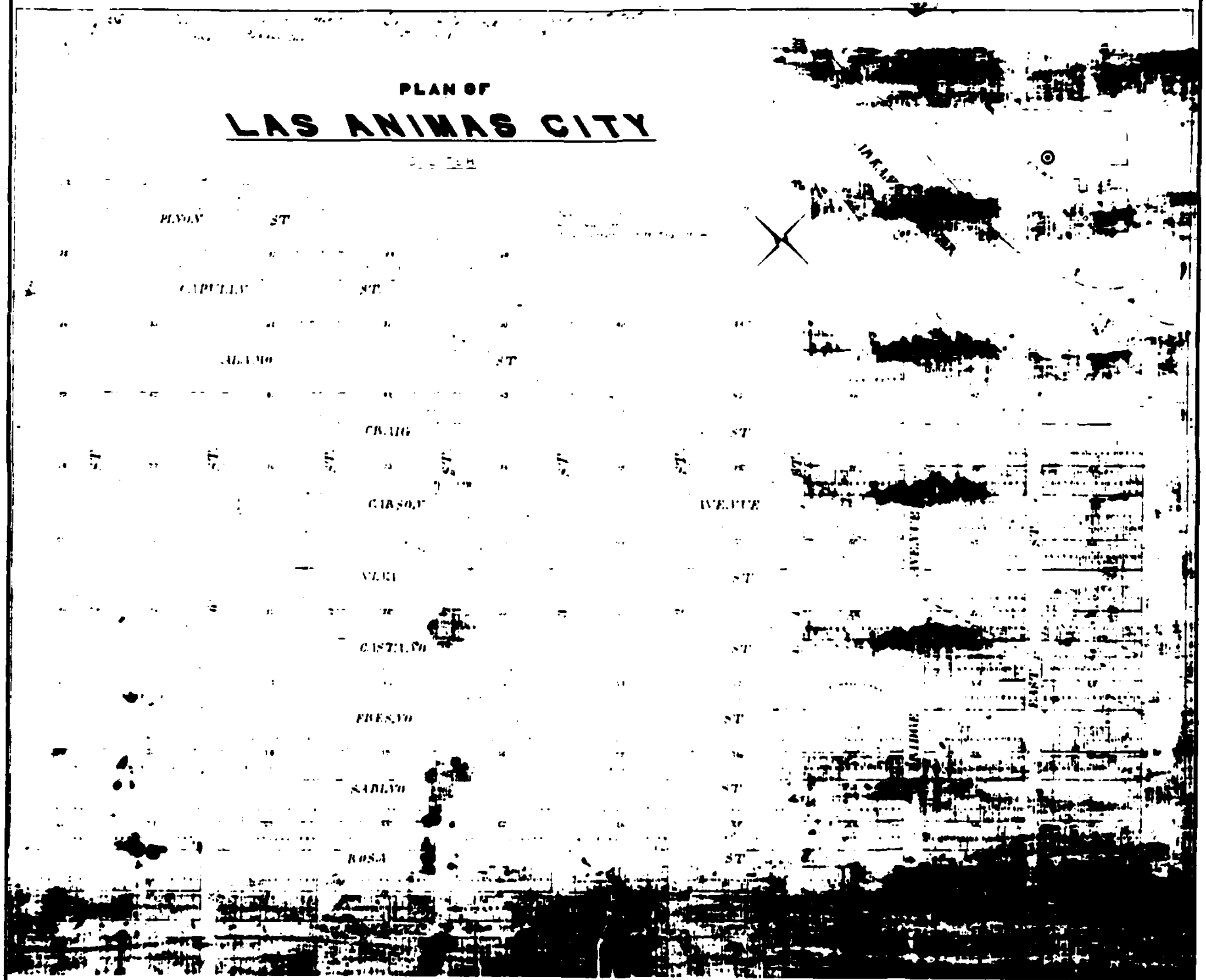


FIGURE 8.4
1869 PLAT MAP OF LAS ANIMAS
JOHN MARTIN RESERVOIR PROJECT



COURTESY OF BENT COUNTY CLERK, LAS ANIMAS, COLORADO.

Site History

JM043 represents the remains of the town of Old Las Animas, also known as Las Animas City, Old Town, or East Las Animas (Figure 8.5). The history of Old Las Animas is a tale of blooming frontier boosterism defeated by outside speculation and local competition. Situated just across the Arkansas River from New Fort Lyon, Las Animas City served as a commercial trade center for the troops at the fort and the surrounding rural countryside. It was hoped that the arrival of the railroad would provide a solid economic base for the town and promote its rapid growth. But instead, the railhead was established at a new townsite, known as West Las Animas, laid out by Denver investors. This new town, located just a few miles from Old Las Animas, captured the regional market and developed into a substantial community while the old town faded from existence.

The site of Old Las Animas was originally part of the Las Animas Land Grant, conveyed by the governor of New Mexico, Manuel Armijo, in January 1844 to Ceran St. Vrain and Cornelio Vigil. This huge tract of land, better known as the Vigil and St. Vrain Grant, contained over 4 million acres and embraced the valleys of the Huerfano, Cucharas, Apishapa, and Purgatoire rivers to their junction with the Arkansas River. In 1860 the United States Congress confirmed the Vigil and St. Vrain Grant, cutting it down to 22 square leagues to 97,000 acres, and recognizing the claims of previous settlers. Captain William Craig, Quartermaster at Fort Union in New Mexico, became Ceran St. Vrain's agent and obtained control over a large portion of the grant after 1862 (Taylor 1968:306).

In 1866 a flood undermined the buildings at Old Fort Lyon, and in June of 1867 the garrison, under the command of Brigadier General William H. Penrose, moved to the location of New Fort Lyon. Since the new location fell within the boundaries of the Las Animas Grant, General Randolph B. Marcy, inspectory general, arranged to lease the property from William Craig on June 12, 1867. The location of the fort gave Craig the idea of establishing a town just opposite from it. He organized the Las Animas Town Company and laid out the site of Las Animas City on the south side of the Arkansas River about two miles east of the Purgatoire River in January of 1869.

On January 28. 1869 the *Colorado Chieftain* of Pueblo printed the following article announcing the birth of Old Las Animas:

> Since we last went to press a new city, known as Las Animas, has been started on the south bank of the Arkansas River, just opposite Fort Lyon. H. M. Foster, surveyor and civil engineer has been making a survey, map and plat of the site, which, we are informed by those of our townsmen who have visited the spot, is one of the finest in the Territory. Buildings are fast dotting the site. Large lumber yard is being established. Col. Wm. Craig, Col. Francisco, and Benjamin D. Spencer have formed a corporation under our Territorial Laws, known as the "Fort Lyon Bridge Co." This company will construct a good bridge across the Arkansas river at the town site - the south end of bridge on a line with the principal avenue. Las Animas Ditch Co. has also been organized with the view of conducting water from the Pugatoire by means of a ditch through the city. The vast stretch of agricultural land along the Arkansas and the Rio de Las Animas river is sufficient of itself to support a large town. The facilities of grazing are unrivaled in the Territory. Finest building stone in unlimited quantities are in sight of the town. A half-dozen excellent quarries may be opened up within a mile of the site. The excitement over the embryo city is intense and increasing.

FIGURE 8.5
OLD LAS ANIMAS
JOHN MARTIN RESERVOIR PROJECT

The early investors and residents of Old Las Animas hoped that when the railroad arrived at this location that they would make a killing. For the railroad would surely bring prosperity and growth to the new town. As the *Colorado Tribune* of February 2, 1869 explained:

> After our whole northern border has felt the railroad influence in the growth and fall of new towns, Southern Colorado becomes suddenly infected, and men of means and men without means rush into the speculation of a new town on the Arkansas, just opposite Fort Lyon. The embryo metropolis has been dubbed "Las Animas City", a very pretty name meaning "The city of Lost Souls".
>
> The immediate cause for a rush for this place is found in the fact that someone has received reliable advice that the railroad will cross the Arkansas River at that point and hence a huge city must follow, and a town site has been laid out, trains of lumber are arriving, buildings are going up, a lumber yard established for those soon to follow, a bridge is to be constructed over the river to act as advance guard for the railroad bridge, and a ditch company has been organized to bring water into the town.

Luke Cahill, a soldier at Fort Lyon who later resided in Old Las Animas, wrote a vivid memoir of his life. In it he recalls that:

> Las Animas was the first town started in Bent County. In the month of January 1869 a man by the name of Jim Blue erected a little board shack and opened a saloon. This place is across the river and about one mile from where the United States Naval Hospital (Fort Lyon) now stands. Soon there arrived a man by the name of George Gardner who erected a large two story adobe building, opened a saloon and dance hall and was largely patronized by the soldiers from the fort. This caused many other business enterprises to spring up and it soon became what they called a lively town. Many women of the red light order arrived. The sound of the deadly forty-five was often heard during the still hours of the night, and the next morning a little funeral would take place without the assistance of a coroner, preacher or undertaker, with no headstone to mark the resting place of the victim (Cahill 1923:36).

According to Cahill, Colonel Francisco and Captain Craig completed their pile bridge across the Arkansas River, connecting Old Las Animas with Fort Lyon, in the summer of 1870. This was a toll bridge, and they charged one dollar for teams and wagons and 25 cents for pedestrians to cross it.

In 1870, when Bent County was first organized by the Colorado Legislature, Las Animas City was designated the temporary county seat. Later that same year, the results of a local election moved the county seat to Boggsville. Then in 1872 the county seat was again moved back to Old Las Animas.

The town was situated in a strategic position and operated as a trade center for local ranchers and for the troops stationed at Fort Lyon. A. E. Reynolds, the sutler at Fort Lyon, had a dry goods store at Old Las Animas. So did R. M. McMurray, who had been an officer at Fort Lyon. In 1873 Charles W. Bowman bought a printing press to town and founded the *Las Animas Leader.* Advertisements in this newspaper indicate the kind of businesses operating in Old Las Animas at that time. There were two hotels, the People's Hotel, owned by Vandiver & Son, and the Merchant's Hotel, run by Soward & Carpenter. Soward also owned a meat market. Gardner & Tate had a billards parlor and saloon. There was a brewery, operated by Charles Wurz.

F. Walker, one of several grocers in town, advertised the sale of liquors and general merchandise. Stewart & Norton, another grocer, sold clothing, china, wines and cigars. Graaf & Co. operated a bakery and restaurant. J. W. Thomas was a druggist. E. M. Hemphill ran a lumberyard. Neibrahaum & Rhoads had a furniture and hardware store. G. M. Woodworth ran a livery stable. The Bobenrieth brothers were wagon makers and blacksmiths. John Bobenrieth was listed in the census for Old Las Animas in 1880 as a 44-year-old "day laborer" from Alsace. The 1900 census listed Charles Bobenrieth, a 56-year-old wheelwright from France, as living in Caddoa. According to Luke Cahill, the Bobenrieth, who worked as a blacksmith in Old Las Animas, was a German who later committed suicide in a St. Louis hospital (Cahill 1923:55). Old Las Animas had a Chinese laundry, run by Long Shong. Several lawyers lived in town, as did a few real estate agents and two doctors. There was an adobe schoolhouse, that on Sundays doubled as a church for both the Methodists and Episcopalians. In 1880 John Murphy, a 31-year-old native of New Jersey, was the school teacher there, according to the census sheets.

Old Las Animas also served as a shipping point for freight companies, stage lines, and teamsters engaged in transporting goods from the railheads near the Kansas border to New Mexico. Around 1870 the Kansas Pacific Railroad extended its line to Kit Carson, a town it built just inside the Colorado state line. The Atchison, Topeka and Santa Fe Railroad wasted little time matching this feat by building its line westward to Granada, a town the railroad established just 12 miles west of the Colorado border, in July 1873. The Barlow and Sanderson Southern Overland Mail and Express Company operated a stage line between Kit Carson and Santa Fe, with Las Animas operating as an important stage stop and office for the company (Taylor 1973). John W. Prowers, a prominent local rancher, and his brother-in-law, John S. Hough, opened a commission house and transfer company in Las Animas City and advertised wholesale groceries.

Old Las Animas soon acquired a reputation as a lively frontier town. Its saloons, dance halls, and gambling houses ran all night. Tales of violence accompanied the drinking and gambling. One incident was recalled by Luke Cahill, involving Black calvary troops stationed at Fort Lyon and local cowboys. Both cowboys and soldiers were drinking one night at George Gardner's dance hall and saloon. When one of the Black soldiers stepped up to the bar he was accosted by a cowboy who demanded, "Nigger what are you doing here." The soldier replied that he just wanted a drink. "You cannot drink with me," the cowboy answered and struck the man, starting a general brawl between the Black troops and the cowhands. Later that same night some of the soldiers snuck up behind a stone corral across the street and fired into the crowded bar, killing one cowboy and wounding four others. The commander of Fort Lyon arrested 14 of the Black calvary troops for the crime. They were eventually turned over to the local sheriff, and two of the soldiers were tried, convicted of murder, and hung (Cahill 1923:45-46).

Vistors were impressed by the rapid development of the town, its cosmopolitan population, and its mixed morals. One wrote of Las Animas as follows:

> Crossing the river (from Fort Lyon) about ¼ mile distant you enter the new town of Las Animas, county seat of Bent. It now has a population of about 250, two hotels, about 20 places of business, and others opened daily. Several houses are built of adobe and several of stone, both of which are cheap and easily obtained - Mexicans may be seen making "dobies." Las Animas is a fast town. It has two dance houses, one American, and the other Mexican. Population mixed, both as to nationality and

morals. Las Animas has in prospect 2 railroads. Extension of the A. T. & S. Fe and the ironing of the Arkansas Valley road; which should make her the most important point in Southern Colorado (*Las Animas Leader*, May 23, 1873).

Another visitor, also focused on the booming businesses in town, and its glowing prospects of becoming a major railroad depot. In his "Views about Las Animas," published in the June 6, 1873 issue of the *Las Animas Leader*, A. Bach wrote:

> SIGHTS: Main Street blazing with all sorts of signs in all kinds of shapes. Dry goods and grocery outfits, furniture establishments, cigars & tobacco, feed stables, drug stores, doctors and dentists signs, billard halls, saloons, Long Shong (washer & ironer), barber shops, lumber yards, blacksmith shops, restaurants, millinery and dress making outfits - 13 variety stores on Main Street. A town that has fought its way along under title difficulties deserves to prosper. Taking into consideration the settlement of the town site question and prospects of having the arms of the K.P.R.R. around your neck, and the fact that your town is center of an immense area of agricultural and stock raising country, all I have to say is, Las Animas, "Your star is rising, never to set while another star shines."

All this booster enthusiasm for the new town was premature, for a shadow hung over Las Animas that would cost it the railhead it so badly wanted, and begin its journey down the road to decline. This shadow was the question over the legal ownership of the Vigil and St. Vrain Grant. On February 25, 1869, the United States Congress had set down a new ruling on the grant, ordering a new survey and stating that derivative claims would be settled and their boundaries adjusted to the new survey. The public land not belonging to the heirs of the grantees, or to squatters who had established the right to their claims, would then be open for preemption or homesteading (Bradfute 1970). Thus William Craig's ownership of the Las Animas townsite was questionable. To settle this problem a citizen's committee met with Craig in June 1873, and he agreed to withdraw his claim to the townsite and allow Probate Judge Asahel Russell to file for a federal patent, "in trust for the several use and benefits of the occupants of the Townsite of Las Animas City" (Bent County, *U.S. Receiver's Receipt & Patent, Book 23:283).* In return the citizens of Las Animas pledged to recognize the titles of all parties holding deeds from the original town company (*Colorado Chieftan*, June 19, 1873).

Unfortunately, uncertainty over the title to the townsite of Las Animas, and competition between two railroads, lead to the creation of a new town, West Las Animas, just a few miles away from Old Las Animas. In 1872 General Robert E. Carr, president of the Kansas Pacific Railroad, with the backing of David Moffat and the Denver & Rio Grande Railroad, attempted to raise subscriptions towards the construction of a branch line from Kit Carson to Pueblo. However, they did not count on the active opposition of the Atchison, Topeka and Santa Fe Railroad which was also building a line through the Arkansas Valley to Pueblo. When the bond issue was held in Bent County the Santa Fe brought in several hundred men from Kansas to stuff the ballot boxes and defeat the Kansas Pacific (Cahill 1923:39). The Santa Fe was much more successful in raising money, convincing Pueblo County to contribute $350,000 in stock subscriptions. Bent County was induced to vote a bond issue for $150,000 to support the enterprise.

While negotiations were still underway with the Kansas Pacific over subscriptions, the railroad completed its branch from Kit Carson to the

Arkansas River. In order to profit from the venture David H. Moffat, Jr. and Robert E. Carr planned to establish a new townsite, rather than risking the title difficulties involved in building their railroad to Old Las Animas. Taking advantage of certain loopholes in the federal requirements for acquiring title to land within the Vigil and St. Vrain Grant, Moffat and Carr obtained control of the land for their new townsite on an unconfirmed portion of the grant under rather suspicious circumstances. When settlers at Old Las Animas learned that Moffat and Carr were going to by-pass their town in favor of the new townsite, a vigorous protest was raised. After February 25, 1873, when persons living around Old Las Animas had attempted to file claims at the Pueblo Land Office for land that later was included in the townsite of West Las Animas, they were told by Register Irving W. Stanton and Receiver Charles A. Cook that the land had already been registered as a derivative claim of one D. W. Hughes. When Hughes relinquished his claim in May 1873 the land was preempted by a group of persons who eventually sold it to Moffat and Carr. The citizens of Old Las Animas challenged the acquisition of the townsite of West Las Animas by Moffat and Carr, claiming that the deeds they received for the land bore the names of fictitious people who never resided there or made improvements on the property. John M. Boggs, the Bent County Recorder, questioned the deal because the land had never been declared open for entry (Bradfute 1970:27).

David Moffat was accused of engineering the land swindle and the public outcry resulted in several court cases, and even prompted a federal investigation. The report of the federal investigation led to the replacement of Stanton and Cook as the register and receiver at the Public Land Office in Pueblo, and indicated that Moffat was involved in the irregular land transactions. But by then the Kansas Pacific had already platted their town, and its tracks reached West Las Animas on October 18, 1873.

Many of the businesses at Kit Carson and Old Las Animas moved to West Las Animas to take advantage of the rail connection. The Atchison, Topeka and Santa Fe Railroad, after a two-year hiatus, completed its line from Granada to West Las Animas in 1875. This marked the beginning of the end for Old Las Animas. It could not hope to compete with the new town served by two railroads located just five miles to the west. As the April 15, 1874 edition of the *Rocky Mountain News* noted:

> Las Animas has been a place of considerable importance for several years. Located near Fort Lyon, it has enjoyed the advantages of trade with the officers and soldiers at the post, and the trade of a large section of the country, but the location of a new town (West Las Animas) at the present terminus of the Arkansas Valley road, about five miles distant, has had the effect to almost depopulate the old town.

In 1875 West Las Animas became the new seat of government for Bent County. That same year the *Colorado Business Directory* credited Las Animas City with a population of 150 persons. The Directory listed the following businesses in Old Las Animas: Blacksmiths - Mike Bobenrieth and J. Osborne; Brewery - William Vollert; General Merchandise - McMurray Brothers and F. Walker & Co.; Hotel - Gilman House, H. S. Gilman, proprietor, and Merchant's Hotel, J. D. Copler; Notary & Real Estate - J. L. Craig; Physician - John Russell; Wagon & Repair Shop - Bobenrieth Brothers and J. Osborn.

Although the founding of West Las Animas sounded the death knoll for Old Las Animas, the town continued to exist as a viable community until the mid-1880s. The manuscript sheets of the U.S. population census give an excellent indication of the composition of the community

at Old Las Animas. 1880 is the only year that the "village of Las Animas" is listed in the census. An examination of this census data shows that Old Las Animas had a population of 103 people. Although there were many single men, the fact that women and children represent over half the total population shows the importance of family life in this community. The town also showed some ethnic diversity. In 1880 8.8% of the adult population was black. Most of these were single women with children. For example, Alice Walters was listed as a 22-year-old Black from Maryland who had two small children and worked as a washerwoman. The presence of such a sizable Black population in this frontier western town is not surprising when one realizes that there were Black cavalry troops stationed at Fort Lyon. Only two people with Hispanic backgrounds were listed on the 1880 census. Both are men without families, who were born in New Mexico, and worked as sheepherders. Some 77% of the adult population of Old Las Animas were whites, born in America. Only three countries, France, Germany and Ireland, were represented in the places of origin of the foreign born living in Las Animas. Two people were born in Germany and one in France. Twelve people, constituting 17.6% of the adult population, listed Ireland as their place of birth.

The listing of occupations for the adults living in Las Animas in 1880 included merchant, grocer, telegraph operator, schoolteacher, wheelwright, teamster, tanner, seamstress, washerwomen, railroad section workers, day laborers. cattleherders, stock growers, sheepherders, farm laborers, farmers. Agricultural pursuits represented 56% of the total male adult work force. Six men worked for the railroad. Most of the women were listed as "keeping house." A more detailed analysis of the population of Old Las Animas can be found in Section 9.0.

After 1880 Old Las Animas steadily declined. In 1882 the *Colorado Business Directory* listed Charles Bobenreith as operating a grocery store and saloon there, while D. J. Lindsey served as postmaster and railroad agent. The 1880 census indicated that David J.Linsdey was a 30-year-old telegraph operator from Ohio who was married and had one child. Around this time the Santa Fe Railroad closed its depot at Old Las Animas. One former resident recalled that by 1883 the only building still occupied in Old Las Animas was a saloon (Ryder 1934). The 1886 *Colorado Business Directory* said of Las Animas: "Old town 4 miles east of West Las Animas. No post office or railroad depot." By 1887 Old Las Animas is no longer listed in the Directory, and by that date it had probably been abandoned. In 1887, the Old Town gone, West Las Animas was incorporated, and dropped the "West" from its name, becoming the present town of Las Animas.

Meanwhile the physical remains of Old Las Animas began to disappear. Many of its buildings were moved to West Las Animas. Those of adobe which remained gradually melted away. The location of Old Town was known to some local residents and the place was looted by pot hunters and collectors, accounting for many of the pits at the site. By the late 1930s, when the U.S. Army Corps of Engineers mapped the area of the John Martin Reservoir, Old Las Animas was no longer visible, and its site was merely noted as a place of "scattered cottonwood and tamarack."

JM044/5BN177 (Ranch Related)

This site is located in the NW¼ of Section 10, T.23S., R.51W. It is stacked stone fence that runs along the top of the terrace just above the Reservoir. In some of the ravines the fence forms a kind of enclosure. It was thought that perhaps these enclosures were used to pen sheep. However, an examination of the local assessment rolls for the owners of this property indicates that this was probably an area used to graze cattle, not sheep.

Site History

According to the Bent County Abstract Books, this tract of land was first patented in 1878 by P. H. McCarthy. Patrick H. McCarthy had been an ordinance sargeant at Fort Lyon. He also became involved in the local cattle business. In 1879 P. H. McCarthy sold the property to Luke Cahill, his business partner and husband of his niece.

Luke Cahill was born in Ireland in 1850 and immigrated with his family to Waterbury, Connecticut, six years later. From there they moved to London, Ontario, Canada. Luke then went to Port Huron, Michigan, and apprenticed as a cooper. For a short time he served in the Union Army during the Civil War. After the war Cahill lived in Chicago for awhile, and in 1866 he reenlisted in the Army and was sent west, eventually ending up as a sergeant serving at Fort Lyon. In 1869 Cahill was discharged from the army and worked for a year for the Barlow and Sanderson stage company at Las Animas. In 1870 Cahill entered into a partnership with Daniel Webster Van Horn, who had been an officer at Fort Lyon, and they purchased a cattle ranch on the north side of the Arkansas River, opposite the site of West Las Animas. In 1873 Cahill sold out to Van Horn and joined the cattle business of Patrick McCarthy, his uncle by marriage. From 1875 to 1877 Luke Cahill served as the Bent County Assessor. He sat on the County Commission from 1883 to 1888. During his long career in public service Cahill also held the offices of County Coroner, Justice of the Peace, and Police Magistrate. He lived the rest of his life in Las Animas (Cahill 1923).

Luke Cahill only held on to the land containing JM044 for a year, and in 1880 he sold it to Jane McCarthy, perhaps a relative of Cahill's partner P. H. McCarthy. On November 10, 1899 Jane McCarthy sold the land to Irene Murry (Bent County, *Quit Claim Deeds,* Book 17:216). Irene Murry was probably related to Malache Murry who owned the adjoining tract which contained sites JM039 and JM040. The 1900 Bent County Assessment Roll indicated that Irene Murry owned 358 acres of land, and the 1910 tax list showed that it was used for grazing purposes.

On May 4, 1920 Mrs. Irene Murry Gillam sold the tract containing site JM044 to D. D. Amis for $1,907.70 (Bent County, *Miscellaneous Record,* Book 102:197). Amis had been renting the property from Irene Murry Gillam for several years, combined with the tract that was owned by Mary Murry. From this date, the history of JM044 has the same chain of title as JM039. In 1923 the land was acquired by John O'Connell, who in turn gave it to Regis College in 1931. The United States purchased the property in 1941.

JM055/5BN182 (Trash Scatter)

JM055 is located in the NE¼ of SE¼ of Section 33, T.22S.,R.50W. It is a multicomponent site. The prehistoric component is a lithic scatter, while the historic component consists of three distinct artifact concentrations within a 44-m area. The artifacts in one concentration (labeled Feature 1) appear to be older than the artifacts in the other dump areas. Three artifacts were collected from Feature 1. One was a brown glass bottle with a stopper top. The second is an aqua colored bottle, probably for patent medicine, labeled "Dr. W. B. Caldwell, Div." on one side, and "Monticello, Illinois" embossed on the other. The fact that it has a screw top lid made it appear to date to the twentieth century. The last collected artifact is a clear glass bottle, labeled "J. R. Watkins Co.". It may also be a patent medicine container. It looks recent in origin and has a screw top lid. Artifacts found in the other two concentrations include clear glass ketchup bottle, a Listerine bottle, wire fencing, tin cans and several cold cream jars. These all appear to be very recent.

Site History

JM055 is located on land that was patented by James T. P. Irvine on June 12, 1889 (Bent County, *Receivers Receipts,* Book 18:363). Irvine intended to farm this land and paid the Arkansas River, Land, Reservoir and Canal Company $1,000 for irrigation rights (Bent County, *Trust and Water Deeds,* Book 32:277). On June 10, 1889 Irvine gave a deed of trust for his land to C. A. Parks as trustee for the Commonwealth Loan and Trust Company from whom Irvine had borrowed $1,600 (Bent County, *Trust Deed Record,* Book 30:146). Irvine defaulted on his loan and so Elias B. Barton, Bent County Sheriff, acting on behalf of C. A. Parks, trustee, offered the property for sale at public auction where it was acquired by Albert B. Coulson on October 31, 1891 for $1,697, including water rights (Bent County, *Deeds,* Book 21:553).

Coulson also gave a deed of trust to C. A. Parks as trustee, for a loan from the Commonwealth Loan and Trust Company (Bent County, *Trust Deed Record,* Book 36:224). Like Irvine, Coulson defaulted on the loan and the property was sold at public auction on May 7, 1894 to William D. Hinman, Robert F. Raymond, and George A. Washburn of Massachusetts for $1,000 (Bent County, *Deed Record,* Book 34:224).

At this same time the taxes on the property had gone unpaid by Irvine for the year 1890 and so the Bent County Treasurer took over the land and sold it on December 14, 1894 to H. Emerson for the amount of the back taxes, $23.45 (Bent County, *Tax Deed Record,* Book 33:18). On September 11, 1895 Emerson quit claimed the property to the Reliance Trust Company of Sioux City, Iowa (Bent County, *Quit Claim Deeds,* Book 17:176).

The taxes on the property containing JM055 were also unpaid for the year 1891, and so the Bent County Treasurer sold the land on October 3, 1892 to L. West Markham for $30.20. Markham then conveyed the property on June 13, 1901 to Richard F. Klett (Bent County, *Tax Deed Record,* Book 33:127).

Klett then went about the task of acquiring the interest of the other parties who claimed ownership in the land. On December 4, 1905 William Hinman and Robert Raymond sold their interest in the property to F. Sothoran. Sothoran then quit claimed it to Richard F. Klett for $160 on May 25, 1907 (Bent County, *Quit Claim Deeds,* Book 51:269). On December 5, 1907, B. M. Webster obtained the interest of the Reliance Trust Company in the tract containing JM055, after he brought suit against that company (Bent County, *Miscellaneous,* Book 56:415).

The rest of the chain of title for JM055 is the same as JM020. In 1917 Richard F. Klett gave the property to his son, Richard H. Klett. In 1926 Richard H. Klett deeded the land to his wife, Flora Klett. The Klett family used the land as a cattle ranch. In 1941 the property was acquired by the United States.

JM056/5BN183 (Farmstead)

JM056 is located in the SE¼ of SE¼ of Section 33, T.22S.,R.50W. The site, which is situated along an access road from Road JJ, is badly disturbed. It consists of a sandstone foundation, the remains of what may have once been a two story structure, a location of a possible cistern, and a few domestic artifacts, mainly bottle glass. The structure was in such poor condition that only its corners could be distinguished. One piece of glass, which was collected, is a thick fragment (9.2 mm) of a bottle neck. It is light blue/or aqua in color, and has a seam or mold mark on one side. It appears to be similar in style to bottles manufactured in the late nineteenth century.

Site History

JM056 was probably the location of the residence of James T. P. Irvine. Irvine acquired a federal patent for the 137-acre tract in 1889, purchasing the land for $1.25 an acre rather than homesteading it. Irvine intended to farm the land, and bought an interest in the Arkansas River Land, Reservoir and Canal Company Ditch (later known as the Fort Lyon Ditch) to irrigate his property. Irvine was not able to make a go of it and lost control of his land in 1891. The chain-of-title for JM056 is the same as JM055, and the site history for the later site should be consulted for further details.

JM065/5BN191 (Farmstead)

This is a multicomponent site located in the NE¼ of NE¼ of Section 3, T.23S.,R.50W. The prehistoric component has been identified as a campsite with scattered artifacts. The historic component centers around the remains of a residential foundation. The foundation is made of shaped sandstone blocks. It was probably a two-room structure, with a porch in the north-east corner. Concrete fragments near the porch area may be the remains of the base of a fire-place. There are remains of window glass among the foundation stones. The house probably had a wooden superstructure. There is evidence of joint supports for a wooden floor. The possible locations of a well and a privy are nearby. An artifact scatter spreads out from the house in a southwesterly direction and includes ceramics, bottle glass, wire nails, metal fragments, and other kind of domestic materials. Although none of the artifacts can be clearly identified by maker's marks, the presence of wire nails, round nails, cork-stopper type bottles, and machine made bottles seem to indicate an early twentieth century date for the site.

Site History

Historical research has shown that JM065 was part of the Baldwin family ranch and farm complex. Charles Baldwin received a federal patent for the 160-acre tract containing JM065 on July 27, 1915 (Bent County, *Miscellaneous Real Estate Record,* Book 207:534). Charles Baldwin and his sons put together a large ranch, acquiring several adjoining tracts of land. Site JM029 was part of this complex, and served as the residence of Charles and Mary Baldwin. The residence at JM065 was probably occupied by another member of the Baldwin family, most likely by Charles' son Francis (or Frank). The 1920 Bent County Assessment Roll showed that the Baldwins combined the tract containing JM029 with the tract containing JM065, and used 200 acres as farmland and 260 acres as grazing land. At that time Charles Baldwin was credited with owning one cow, five mules, and seven horses, so farming activities on the property were probably more important than livestock raising.

That assumption that it was Frank Baldwin who occupied the house at JM065 is reinforced by the 1930 Bent County Assessment Roll which listed him as the owner of that property. Frank used the entire 480-acre tract as irrigated farm-land. Frank Baldwin was given fee title to the property containing JM065 by his father, Charles Baldwin, on November 10, 1934 (Bent County, *Warranty Deeds,* Book 182:353).

An interesting story about Frank Baldwin concerns a fight he got into with one of his employees. On May 18, 1911 Harry L. Bigger was working for the Baldwin Brothers on their ranch when a heated argument broke out between Bigger and Frank Baldwin. During the course of the fight which ensued, Baldwin bit off Bigger's nose. Bigger took the case to court and was awarded $1,250 in damages, putting a lien against the Baldwin property until the penalty was paid by Frank Baldwin (Bent County District Court

Case No. 717, *Harry L. Bigger vs. Frank Baldwin*).

Frank Baldwin held on to the property containing JM065 until it was purchased by the United States on June 2, 1942 for $839.75 (Bent County, *Miscellaneous Real Estate Record*, Book 210:377).

JM069/5BN195 (Farmstead)

This site is located in the SW¼ of NE¼ of Section 34, T.22S.,R.51W. It is a multicomponent site, with a prehistoric lithic scatter mixed in with the historic features. The historic features of JM069 consist of a cement block foundation, with the east and north walls incomplete; a brick scatter just south of the foundation; and various artifacts. The structure may have been a shed. The artifacts present include earthenware pieces, metal fragments, and bottle glass. None of the artifacts listed on the mapping form appear to be temporally diagnostic.

Site History

The foundation and other features at JM069 may be the remains of the Pierce homestead. On December 12, 1888 Joseph A. Pierce was granted a federal patent, according to the Homestead Act of 1862, for the 160 acres contained within the NE¼ of Section 34, T.22S.,R.51W. (Bent County, *Patent Record*, Book 41:128). On March 26, 1907 Joseph Pierce gave a half interest in this property to Elisa Jane Pierce, probably his wife or daughter (Bent County, *Warranty Deeds*, Book 57:484). This deed showed that the land was irrigated, for it indicated that Pierce owned 72 shares in the Fort Lyon Canal Company. On March 31, 1911 the Pierces sold their farm, a total of 189 acres including the site of JM069, to P. C. Nelson for $8,075. This included the water rights to the Fort Lyon Canal, which was then being used to irrigate the land and the so-called "Pierce Ditch" (Bent County, *Warranty Deeds*, Book 62:497).

Nelson probably continued to operate the property as a farm, with limited grazing. The 1920 Bent County Assessment Roll showed that Nelson owned 60 acres of farmland and 184 acres of grazing land. The only livestock listed was five horses. On February 13, 1932 P. C. Nelson sold the property to Jessie Jacobson, Florence Jacobson, Ruby Jacobson, and Anna Jacobson, including all water rights (Bent County, *Warranty Deeds*, Book 62:497). The Jacobsons sold the property to the United States for $1,775 on August 10, 1940 (Bent County, *Miscellaneous Real Estate Record*, Book 205:280).

JM071/5BN197 (Farmstead)

This site is located in the NE¼ of NW¼ of Section 35, T.22S.,R.51W. It is the remains of a sandstone house foundation and associated artifact scatter. The structure was rectangular in shape, approximately 5 m x 10 m in dimensions. Two concentrations of rubble, one on the north side and one on the south side, show that the structure had two fireplaces. Sandstone rocks on the west side of the structure indicate a porch may have once stood there. There are several concentrations of window glass mixed in with the foundation stones. The sandstone foundation appears to have been a support for the floor. The house probably had a wooden superstructure, as was typical for the region. On the east side of the foundation was a concrete underground cistern and the possible locations of a privy and a root cellar. Depressions to the north and east of the structure indicate the location of various former outbuildings. Surrounding the foundation is an intense scatter of domestic artifacts including ceramics, bottle glass, square nails, stove parts, and other metal objects. The presence of bottle necks with hand applied lips, cork-type bottle necks, and "purpled" glass indicates a date of occupation from the late nineteenth century to about the beginning of World War I. One bottle base of light blue glass had a marker's mark which read "AB," indicating

that this bottle was manufactured by Adolphus Bush Glass Manufacturing Company, Belleville, Illinois, between 1904 and 1907 (Toulouse 1971:26).

Site History

JM071 is the location of the Gass homestead. On April 17, 1899 Emil A. Gass received a federal patent for the 160 acres within the NW¼ of Section 35, T.22S.,R.51W., in accordance with the Homestead Act of 1862 (Bent County *Patent Record,* Book 14:83). Emil Gass transferred ownership of the 160 acres to Claria Marie Gass, either his wife or daughter on May 11, 1899 (Bent County, *Warranty Deeds,* Book 39:443). However, the Bent County Assessment Rolls continued to list Emil Gass as the owner of the property. The 1910 tax list indicated that the land was used for grazing, but no livestock were enumerated.

On January 20, 1923 Claria Maria McDaniel, nee Gass, of Pueblo, Colorado, sold the 160-acre tract containing JM071 to Thomas L. Ely for $800 (Bent County, *Warranty Deeds,* Book 118:540). The residence was probably abandoned around this time, as the artifactual evidence would seem to indicate. The new owner, Thomas Ely, did not live long enough to enjoy the property. His estate sold the land to P. C. Nelson on March 31, 1930 (Bent County, *Decree Record,* Book 165:526).

From this point on JM071 shares the same chain-of-title as JM069. In 1932 Nelson sold the property to the Jacobsen family. The United States acquired it in 1940.

JM078/5BN203 (Farmstead)

This site is located in the SE¼ of SW¼ of Section 26, T.22S.,R.51W. Its major feature is a sandstone foundation, with window glass amidst the stones. There is a brick concentration to the southeast of the foundation. A rectangular feature of unknown function, probably the location of some sort of outbuilding, is to the south of the bricks. Around the features is a fairly dense scatter of domestic artifacts including ceramics, stove parts, nails, tin cans, and bottle glass. The presence of square cut nails and bottle necks that fit corkstoppers lend the impression that this site was occupied in the late nineteenth and early twentieth century.

Site History

JM078 is the homestead of Fannie A. Clay. Fannie Clay received a federal patent for Lot 3 of Section 26, T.22S.,R.51W., containing 34 acres, on May 10, 1910. Bent County assessment tract maps confirm that the Clay homestead included the site of JM078. The local assessment rolls indicate that the 34 acres were used as grazing land. Fannie Clay controlled this property for 32 years, until it was acquired by the United States on July 31, 1942 for $182.12 (Bent County, *Decree Record,* Book 199:491).

JM082/5BN207 (Farmstead)

This site is located in the SW¼ of SW¼ of Section 25, T.22S.,R.51W. It consists of a concrete house foundation and associated artifact scatter. The style of construction appears recent, and the artifacts seem to date from the 1930s or even later. Included in the artifactual assemblage are "Fiesta-ware" ceramics, and machine made bottles. The house dimensions are about 10 m x 10 m, divided into two sections by a concrete interior wall, 15 cm thick. There is a doorway on the east side, and another on the west. The artifact scatter is concentrated just east of the foundation, between the house and a dirt road. A line of trees is to the north of the structure, and a group of trees surrounds the house.

One of the crew members who recorded this site believed that an earlier structure may have

existed there and was torn down when the new concrete foundation was put in. The main evidence for this theory was the presence of a concrete walkway that led right into a foundation wall, instead of a door. However, the other evidence, both historical and visual, seem to favor the fact that there was only one house built at this spot, represented by the concrete foundation. It has also been suggested that the house the foundation was laid for was not completed before it was purchased by the United States, because the south side of the foundation is missing. A more likely explanation is that the house was built in the 1930s, and the superstructure removed after the COE acquired the property. The use of heavy equipment, such as a bulldozer, during the demolition process could have destroyed the south wall of the foundation.

Site History

On May 3, 1889 the State of Colorado gave Stuart A. Henry a patent for 1,033 acres for $1,459.75 (Bent County, *U.S. Receiver's Receipt & Patents,* Book 23:265). Included in this tract was the SW¼ of Section 25, T.22S.,R.51W., which contains the location of site JM083. Stuart Henry probably did not live at the site, since the deed indicated that he resided in Arapahoe County. On April 27, 1889 Henry borrowed $1,000 from the Lombard Investment Company, and used this property in Bent County as collateral, giving a deed of trust to Frank Atkins as trustee (Bent County, *Trust and Water Deeds,* Book 32:85). When Henry defaulted on this loan his property was sold at public auction to Mary T. Wadsworth, the highest bidder, who paid $800 to acquire the W½ of the SE¼ of Section 25, an 80 acre tract that included water rights to the Arkansas River, Land, Reservoir and Canal Company Ditch (Bent County, *Deed Record,* Book 34:302). Thus by 1894, the year Wadsworth purchased the property, it is known that the site JM083 was located on an 80-acre tract of irrigated farm land.

Mary Wadsworth moved to New Jersey, and on August 15, 1898 sold the 80 acres in the W½ of the SW¼ of Section 25 to L. L. Froman for $700, including water rights (Bent County, *Warranty Deeds,* Book 39:358). Froman then turned around and sold the property that same day for $50 to Frank Kreybill (Bent County, *Warranty Deeds,* Book 39:571).

On April 14, 1900 Frank Kreybill sold the 80 acre tract to Rowena Ford for $2,000 (Bent County, *Warranty Deeds,* Book 39:572). The high price of the property may have been due to the fact that it was irrigated. It is doubtful that any buildings were on it, since the Bent County tax roll for 1900 only listed $28 worth of improvements. By 1910 the tract was no longer being used for farming, and the Bent County Assessment Roll listed it as grazing land. In 1920 it was still used for grazing, but no livestock were listed. By 1930, however, the 80 acres was again described as irrigated farmland in the assessment rolls.

On April 11, 1934 Rowena Ford gave part of her property to Edgar A. Ford, probably her son (Bent County, *Warranty Deeds,* Book 182:345). It may have been Edgar Ford who built the house with the concrete foundation at JM083. This guess is reinforced by the fact that in 1930 the assessed value of this property was only $1,000, but when Edgar Ford and his wife, Bertha, sold the property to the United States on June 5, 1941 they were paid $2,270 for the land (Bent County, *Miscellaneous Real Estate Record,* Book 207:267). This increase in value may be due to the fact that Edgar Ford built a house on the property. Certainly, the artifacts at the site indicate a date no earlier than the 1930s for the house.

JM101/5BN225 (Farmstead)

JM101 is located in the SW¼ of NW¼ of Section 17, T.23S.,R.49W. It is a sandstone

foundation with no evidence of a superstructure, and no artifacts were found in its vicinity.

Site History

This site may be the remains of the Myers homestead. In January of 1922, Jennie Myers was granted a federal patent for the 160 acre tract which contains site JM101 in accordance with the Homestead Act of 1862 (Bent County *U. S. Patent Record,* Book 130:161). This propety stayed in the hands of the Myers family until it was acquired by the United States for the John Martin Dam and Reservoir. On August 21, 1937 Jennie Myers gave the land to Otto Myers, perhaps her son (Bent County, *Warranty Deeds,* Book 192:225). The United States purchased the tract from Otto Myers for $320 on January 11, 1940 (Bent County, *Warranty Deeds,* Book 203).

JM105/5BN228 (Farmstead)

This site is located in the SW¼ of NE¼ of Section 13, T.23S.,R.50W. It consists of a stone and concrete house foundation, a cistern, and associated occupational artifacts. The artifacts included aqua, brown, and purple bottle glass, remains of fruit canning jars, ceramics, and metal. One purple bottle base bore the maker's mark "U.D. Co." showing that it was probably manufactured by the United Drug Company between 1910 and 1930 (Toulouse 1971:509). Another purple glass bottle base read "W. F. & S. Mil." indicating that it had been manufactured between 1900 and 1929 by William Franzen & Sons glass company of Milwaukee, Wisconsin (Toulouse 1971:536).

Site History

The remains at JM105 are probably related either to the Graham homestead or the Morgan ranch. On March 7, 1889 Mary S. Graham paid $200 at the Receiver's Office at Lamar, Colorado for the W½ fo NE¼ and N½ of NW¼ of Section 13, T.23S.,R.50W., containing 160 acres (Bent County, *Receiver's Receipts,* Book 18:331). On March 29, 1889 Mary S. Graham, noted as a widow, sold the property for $400 to Mary A. Graham, perhaps her daughter (Bent County, *Warranty Deeds,* Book 3:331). Mary A. Graham also owned several town lots in the settlement of Caddoa, located nearby. However, taxes went unpaid on the 160 acre tract, and on January 8, 1917 John Morgan acquired the property from the Bent County Treasurer (Bent County, *Tax Deeds and Release of Mortgages,* Book 58:192).

One of the former teachers at the school in the town of Caddoa remembered that the Morgan family consisted of three or four children who "didn't have much." Their mother was from Scotland (Mrs. Dorothy Boyd August 12, 1980: personal communication). The Bent County Assessment Roll showed that the Morgan family owned 890 acres of grazing land in 1920. The Assessor's Notebook of 1924 listed 5 horses and 132 head of cattle as John Morgan's personal property. So there is little doubt that the tract containing JM105 was being used as a cattle ranch. On November 7, 1924 John Morgan gave the property to his wife, Maggie E. Morgan (Bent County, *Warranty Deeds,* Book 136:381).

On December 23, 1924 Maggie Morgan gave the 160-acre tract including site JM105 to James Lumpkins, Jr. (Bent County, *Warranty Deeds,* Book 136:400). Lumpkins gave the property back to Maggie Morgan on November 15, 1937 (Bent County, *Warranty Deeds,* Book 192:293).

In the District Court case of *USA vs. Keesee Water and Land Company, et al.,* it was determined that the United States would pay Mrs. Morgan $400 for the 160 acres. Maggie Morgan quit claimed the property to the United States on July 9, 1942 (Bent County, *Miscellaneous Real Estate Record,* Book 205:410).

JM111/5BN234 (Farmstead)

This site is located in the NW¼ of NW¼ of Section 14, T.23S.,R.50W. It consists of six structural foundations and associated artifacts. Structure No. 1 is a rectangle of sandstone blocks. Structure No. 2 is a poured concrete base, about 2 m square, with the walls fallen over. The concrete walls show impressions from being formed with 1" by 2" wooden boards and are 15 cm thick. Structure No. 3 is a group of sandstone blocks about 3 m across. Structure No. 4 is a circular poured concrete floor 5 m in diameter surrounded by sandstone blocks, about three layers high. Only three sides of Structure No. 5 are discernable. The southern wall has fallen over. Each of the walls is about 5 m long. Structure No. 6 is a few sandstone blocks outlining the walls forming one corner around a poured concrete floor. The walls of this structure are about 30 cm thick and the concrete is only 65 cm across. The function of this structure is difficult to determine. The artifact scatter appears recent (early twentieth century) in origin. It includes bottles with screw-type lids, earthenware ceramics, sheet metal, and barbed wire.

Site History

JM111 may be the remains of the Bromley homestead. On October 3, 1920 Wilbur T. Bromley acquired a federal patent for 640 acres, by depositing a Certificate of the Register of the Land Office in Lamar, Colorado in the General Land Office in Washington D.C. (Bent County, *U.S. Patent Records,* Book 105:300).

Bromley sold the property to George F. Schillinger of Colorado Springs on March 7, 1927 (Bent County, *Warranty Deeds,* Book 148:385). The 1930 Bent County Assessment Roll showed that the 640 acres was used for grazing purposes. On May 19, 1936 Schillinger granted the property to George R. Swallow of Denver (Bent County, *Warranty Deeds,* Book 192:18). The United States purchased the 640-acre tract from the Swallow estate for $1,280 on February 6, 1940 (Bent County, *Miscellaneous Real Estate Record,* Book 205:5).

JM119/5BN241 (Farmstead)

This is a multicomponent site located on the east side of Rule Creek in the NW¼ of NW¼ of Seciton 21, T.23S.,R.50W. The historic component of this site consists of the remains of 4 possible structures and associated artifacts. The historic structure farthest west was probably a tool shed, as evidenced by the concentration of artifacts there, including farm machinery, automobile parts, and window glass. An insulator for an electric line indicated that the site had electricity. To the east is the main house complex, dominated by a poured concrete slab which probably represents the floor of a residence. Nearby is a rectangular sandstone slab structure, with the walls standing several layers high, of unknown function. There are scattered foundation stones just north of the concrete slab, indicating the location of the fourth structure. A fieldstone walkway connects the concrete slab with this other foundation. Certain areas around the main house complex show evidence of having been bulldozed. The artifact scatter includes domestic artifacts like bottle glass and ceramics, as well as metal tools and machine parts.

Site History

This site is the location of the Gerstenkorn homestead. On November 23, 1920 Dick Gerstenkorn received a federal patent for the E½ fo NE¼ of Section 20, the NW¼ and the W½ of NE¼ of Section 21, T.23S.,R.50W., containing 320 acres. On February 21, 1928 Dick Gerstenkorn quit claimed the property for $1,409 to Marie M. Gerstenkorn, who was probably his wife (Bent County, *Quit Claim Deeds,* Book 125:449). Marie M. Gerstenkorn later gave the property back to Dick Gerstenkorn on April 5, 1933 (Bent

County, *Miscellaneous Real Estate Record,* Book 190:170). The 1930 Bent County Assessment Roll indicated that the Gerstenkorns used the property as grazing land. The 1929 Assessor's Notebook showed that they owned 8 horses and 60 head of cattle.

The Gerstenkorns quit claimed their ranch to the Bent County Bank of Las Animas on June 3, 1940 (Bent County. *Quit Claim Deeds,* Book 202:75). The deed indicated that part of the Gerstenkorn property was used for farming because an irrigation ditch from Rule Creek was mentioned. The fact that some farming was going on in conjunction with livestock raising is reinforced by the presence of farm machinery parts in the artifact scatter at the site. The United States acquired this property from the Bent County Bank on October 22. 1940 (Bent County, *Quit Claim Deeds,* Book 202:104).

JM120/5BN242 (Farmstead)

This site is located in the NE¼ of SW¼ of Section 20, T.23S.,R50W. It is a ranch complex with a wooden corral still standing, the remains of seven stone structures, and associated artifacts. The artifacts at JM120 include salt glazed stoneware, tin cans, remains of canning jars, and purple, brown and aqua colored bottle glass.

Structure No. 1 is cut into the hillside just west of the corral. It is a dugout constructed of sandstone blocks, with a wooden cross beam running halfway through the structure. The roof is gone, and a door faces east. Wall slump and roof fall covers the floor. Just outside the dugout is a well or cistern. The presence of domestic artifacts, such as tin cans, earthenware ceramics, and purple glass around the dugout indicate that it was probably used as a residence.

Structure No. 2 is an alignment of dry-laid sandstone blocks forming 3 walls cut back into the hillside to the northwest of Structure No. 1. The placement of posts and barbed wire in front of the stone walls give this the appearance of some type of stock pen. Structure No. 3 is a sandstone block building west of Structure No. 2. It is divided into three rooms, measuring approximately 8 m by 4 m each. The middle room has a 1-m-wide doorway on the southern side. Historic trash is scattered around this structure, and sawed pieces of lumber are found inside rooms two and three. Structure No. 4 is situated on the hillside above Structure No. 3 to the south. It is a rock alignment forming a room cut into the hill. Its function is unknown.

Structures 5, 6 and 7 are found together on the other side of the road, north of the hill containing the other structures. Structure No. 5 consists of two walls of mortared sandstone blocks which have fallen over. Scattered artifacts are found west of this structure. Structure No. 6 is several piles of stones. It is interpreted as some kind of stock enclosure or shed with two stone walls and a roof supported by wooden pylons. Similar kinds of structures have been seen in this region still standing. Structure No. 7 is two lines of large sandstone blocks running north to south, and jumbled piles of stones on the east and west sides. This may have been a residence or outbuilding with a wooden superstructure. The superstructure is now missing, and only the foundation stones remain. It has been suggested that the stones used in Structures 5, 6 and 7 look lighter in color and less worn than those used in Structures 1, 2, 3, and 4.

Site History

JM120 is the ranch of Carrie Allen. On August 21, 1913 Carrie E. Allen obtained a federal patent for the NE¼ of SW¼ and the N½ of SE¼ of Section 20, and NW¼ of SW¼ of Section 21, T.23S.,R.50W., containing 160 acres (Bent County, *U.S. Patent Record,* Book 149: 392). Carrie Allen held on to this property until it was acquired by the United States. The

Bent County Assessment Rolls indicate the land was used for grazing purposes, but no livestock were listed. The United States purchased the tract from Carrie Allen on March 27, 1941 for $560 (Bent County, *Warranty Deeds,* Book 203:455).

JM121/5BN243 (Ranch Related)

This site is located in the NE¼ of SW¼ of Section 20, T.23S.,R.50W. It consists of one major feature, a hand-dug, stone-lined well, with a concrete machine pad next to it. At the bottom of the well is an iron pipe, and there is a concrete trough at the east side, near the top. A row of stones in a line leading to the east may have been the supports for a pipeline. The well is situated on the east bank above Rule Creek. Artifacts scattered around the site include tin cans, wire nails, and clear, brown and aqua bottle glass.

Site History

This well is related to the operation of the Carrie Allen ranch. It may have had a pipeline that led to Structures 5, 6, and 7 at JM120. The well falls within the tract first homesteaded in 1913 by Carrie Allen. It, therefore, has the same chain of title as JM120.

JM127/5BN249 (Ranch Related)

This site is located in the SE¼ of SE¼ of Section 19, T.23S.,R.50W. The main feature at this site is a stone and concrete dam across part of the inactive channel of Rule Creek. The dam is constructed of blocks of sandstone cemented together and is approximately 15 m long and 4.9 m wide. Part of the dam is missing, having been removed or washed out by a flood. On the east side of the creek canyon wall an area of rock had been cut away to form a spillway. A concrete and stone wall was constructed on the edge of this ledge as support for the spillway.

Site History

Unfortunately, nothing is known about this dam. It was probably related to ranching activities along Rule Creek. Local records offer little information concerning the history of this site. This land was never owned by private individuals, and was passed from the United States to the state of Colorado in 1921 and then back to the United States in 1940.

JM131/5BN251 (Ranch Related)

This site is located along Rule Creek, at the southern end of COE property, in the NE¼ of SW¼ of Section 30, T.23S.,R.50W. It is a multi-component site. The historic component consists of a concrete slab and sandstone and concrete blocks scattered over the area. Historic artifacts associated with this site include tin cans, iron plow tines, and unidentifiable pieces of metal. The function of the construction materials (i.e., the concrete and sandstone blocks) is unknown. The lack of domestic artifact such as ceramic or bottle glass, and the presence of mechanical artifacts like farm tools indicate that this site was ranch or farm related, but perhaps not a habitation site. The fact that this land was never patented by a private individual reinforces that theory.

Site History

Because this land was never patented by a private individual it is almost impossible to trace its history through local records. This tract of land was transferred in 1921 from the United States to the state of Colorado, and in 1940 the state of Colorado transferred ownership back to the United States.

JM152/5BN256 (Farmstead)

This site is located in the SE¼ of SW¼ of Section 29, T.22S.,R.50W. It is situated on the

west edge of the water line for McRae Arroyo. The site consists of several sandstone alignments indicating the location of structures, and associated artifactual debris. The sandstone alignments indicate that there were at least two and possibly three buildings or more at this site. One group of sandstone blocks forms a rectangular foundation. The other alignments are to the north, and each represents just one wall of a possible structural foundation. To the east of the sandstone lines is a depression, the function of which is unknown. There is also a cistern or well located nearby. The artifacts present at the site appear to date from the late nineteenth and early twentieth century. The artifact scatter includes ironstone and earthenware ceramics, purple colored bottle glass, both square and round nails, and various pieces of metal. It seems that the building may have had a wooden superstructures, as evidenced by the many nails found and by known local construction techniques. These structures were probably destroyed by fire. There is melted glass mixed in among the sandstone blocks, and many pieces of ceramics show evidence of burning.

Site History

The remains at JM152 represent structures associated with either the Lund homestead or the Huey ranch. Peter H. Lund purchased the 160 acres contained in the SW¼ of Section 29, T.22S.,R.50W. on June 12, 1889, paying $200 to the Receiver's Office at Lamar, Colorado (Bent County, *Receiver's Receipts*, Book 18:364). On that same day Lund assigned a deed of trust to C.A. Parks as trustee, to guarantee a loan of $1,850 from the Commonwealth Loan and Trust Company (Bent County, *Trust Deed Record* Book 29:312). The deed of trust was for the 160 acres, with water rights to irrigate 80 acres of the tract, derived from the Arkansas River, Land, Reservoir, and Canal Company, "together with all building situated thereon". Peter Lund defaulted on his loan, and his property was sold by the local sheriff at public auction on November 2, 1891 to Albert B. Coulson, the highest bidder, who paid $1,762 for the SW¼ of Section 29, and water rights for the irrigation of 80 acres of the property from the Arkansas River Land, Reservoir, and Canal Company (Bent County *Deeds* Book 21:560). Lund's deed of trust and the subsequent deed to Coulson indicated that the property was used as irrigated farmland, and the phrase "together with all buildings situated thereon" may mean that Lund had built some structures on the tract. Perhaps the features as JM152 are the remains of these buildings.

Albert Coulson also borrowed money from Commonwealth Loan and Trust Company, assigning a deed of trust to C. A. Parks as trustee for the SW¼ of Section 29 to secure the loan (Bent County, *Trust Deeds,* Book 36:230). When Coulson defaulted on the loan, the property was sold at public auction to William Hinman, Robert Raymond, and George Washborn, who paid $1,000 for it on May 7, 1894 (Bent County, *Deed Record,* Book 34:226). On December 4, 1905, Hinman et. al. conveyed the property to J. F. Sothoran (Bent County, *Miscellaneous Record,* Book 47:497). Sothoran then quit claimed the land to Luella S. Huey on May 25, 1907 (Bent County *Quit Claim Deeds,* Book 51:516.)

The Huey family also acquired the interest of other parties in the land. In 1891 the Bent County Treasurer sold the SW¼ of Section 29 to H. Emerson, because taxes on the property had gone unpaid in 1890 (Bent County *Tax Deed Record,* Book 33:20). On September 11, 1895, Emerson quit claimed the tract to the Reliance Trust Company of Sioux City, Iowa (Bent County, *Quit Claim Deeds,* Book 17:176). B. M. Webster then acquired an interest in the property as a result of a law suit he won against Reliance Trust in 1908 (Bent County, *Miscellaneous Record,* Book 56:233), On April 13, 1911 Webster quit claimed his interest in the land to Thaddeus Huey (Bent County, *Quit Claim Deeds,* Book 51:559).

On August 1, 1914, Luella Huey paid Albert E. King, Charles A. Robinson, and Frances C. King $225 for their interest in the SW¼ of Section 29 (Bent County, *Quit Claim Deeds,* Book 69:168). Albert King had acquired his interest in the property in 1910 through the Bent County Treasurer who sold it for unpaid taxes due for 1891 (Bent County, *Tax Deeds and Release of Mortgage,* Book 58:115).

It is not known if the property containing site JM152 was occupied from the time it was abandoned by Lund until it was acquired by the Hueys. Certainly the conflicting claims of ownership would have complicated the matter. Also most of the owners during the period 1891 to 1903 were from outside Bent County. The Hueys lived in Bent County and could have resided at JM152. Or the structural remains found at the site may just be outbuildings related to the operation of the Huey ranch complex. The Huey family also owned the property containing site JM037 as well as lots in the town of Las Animas. However, JM037 is on the south side of the river, while JM152 is on the north side. It is possible that while the land was unoccupied, the Hueys took it, and then later settled with the various owners. This bit of speculation is supported by the fact that Thaddeus Huey deeded the SW¼ of Section 29 to his wife, Luella, on February 18, 1903 (Bent County, *Warranty Deeds,* Book 46:522), yet he did not acquire legal title to the land until he bought out the interest of B. M. Webster in 1911. While they owned the land, the Hueys kept changing the legal title from husband to wife. On July 31, 1914 Luella Huey deeded the property to her husband, Thaddeus (Bent County, *Warranty Deeds,* Book 70:533). Thaddeus Huey then gave the tract back to Luella on September 18, 1916 (Bent County, *Warranty Deeds,* Book 80:272). Then on March 26, 1918 Luella deeded the property back to Thaddeus (Bent County, *Warranty Deeds*, Book 92:7). The 1910 Bent County Assessment Roll showed that Thaddeus Huey owned over 1,190 acres of land. His personal property included: 19 horses, $570; 3 mules, $120; 127 cattle, $967; 1 clock, $5; 1 musical instrument, $50; 2 vehicles, $10; furniture, $100; and agricultural implements, $25. The deeds and assessment rolls indicate that Huey operated a livestock ranch with supplemental small scale agricultural activities. The 1910 tax list indicated that the SW¼ of Section 29 was used for grazing land.

On December 6, 1919, Thaddeus Huey entered into a contract to sell his ranch to John W. Phares of Trego County, Kansas for $45,000, including "one ditch plow, one steel A-1 stacking outfit (at Russians), 1 McCormick mower, and one hay rake." However, the deal fell through, and Phares signed a release of contract on March 22, 1920 (Bent County, Book 103:413; Book 82:246). Instead Huey sold the ranch to Charles E. Pond of Colorado Springs, Colorado on January 15, 1920. The transaction included 1,244 acres and water rights associated with the so-called "Huey Ditch" and 144 shares in the Fort Lyon Canal Company (Bent County, *Miscellaneous and Mortgage Deeds,* Book 103:414). The 1920 Bent County Assessment Roll showed that Pond used 1,224 acres for grazing, and 150 acres for farming purposes.

Charles Pond did not keep this ranch for long, on July 20, 1920 he sold the tract, now containing 1,404 acres including water rights, to O. B. Looney of Jackson County, Missouri (Bent County, *Warranty Deeds,* Book 104:415). Looney was to own this property, on and off, for the next 20 years. On October 18, 1921 O. B. Looney sold the ranch to W. W. Kile. By this time the ranch had grown to 1,564 acres (Bent County, *Miscellaneous and Mortgage Deeds,* Book 119:528). Kile gave the property back to Looney on June 16, 1925 (Bent County, *Miscellaneous Record,* Book 146:325). On January 3, 1935 Looney gave the ranch to Erma G. Shirley of Jackson County, Missouri (Bent County, *Miscellaneous Real Estate Record,* Book

86:527). For some unknown reason between January 3, 1935 and January 4, 1935, Erma Shirley and Owen and Marie Looney traded the Bent County ranch back and forth four times. Owen Looney then kept possession of the property from January 4, 1935 to March 7, 1941 when the United States acquired it for $13,027 (Bent County, Book 203:446).

JM153/5BN257 (Farmstead)

This site is located in the SW¼ of SW¼ of Section 30, T.22S.,R.50W. It is situated just northeast of the corner of Road JJ and Road 18. The site centers around a depression which may have once been a house with a cellar. Today the depression looks like an abandoned water hole, and is filled with trash. East of the depression is a cistern surrounded by concrete blocks. Next to it sits a concrete machine mount, which perhaps once had a pump for the cistern attached to it. Further to the east of the cistern is a pile of sandstone rubble, perhaps the location of an outbuilding. West of the depression is a circle of stones which appears to have once been a well. Scattered around the site are domestic artifacts, including ironstone and earthenware ceramics, purple and green bottle glass, round and square cut nails, tin cans, and metal fragments or pieces of tools and implements. These artifacts seem to date to the early decades of the twentieth century.

Site History

JM153 probably represents the remains of the Dwyer farmstead. On April 20, 1892 Edward Dwyer paid $200 to the Receiver's Office for a federal patent to the SW¼ of Section 30, T.22S., R.50W. (Bent County, *U.S. Receiver's Receipts and Patents,* Book 23:285). The 1910 Bent County Assessment Roll showed that part of this tract was used for farming and part for grazing.

On February 1917 Edward Dwyer sold the S½ of the SW¼ of Section 30 to John Dwyer, probably a relative, for $2,190. The deed specified that these 80 acres included 36 shares of capital stock in the Fort Lyon Canal Company for the irrigation of the land (Bent County, *Warranty Deeds,* Book 80:386). The 1930 Bent County Assessment Rolls listed the 80 acres owned by John Dwyer as farmland. Thus both the deeds and the assessment rolls clearly show that the tract containing JM153 was operated as a farm by the Dwyer family. John Dwyer held on to the property until it was acquired by the United States on August 7, 1940 for $869.68 (Bent County, *Warranty Deeds,* Book 203:268).

JM155/5BN259 (Farmstead)

This site is located in the NE¼ of NW¼ of Section 31, T.22S.,R.50W. It is a multicomponent site. The prehistoric component is basically a lithic scatter. The historic part consists of a low mound of unknown function, a depression that may have been the location of a structure, and a light scatter of domestic artifacts. The artifacts include square nails, tin cans, and purple and green bottle glass. One purple glass bottle base had the marker's mark "S B & G Co" on it, indicating that it had been manufactured between 1881 and 1905 by the Streator Bottle & Glass Company, Streator, Illinois (Toulouse 1971:461).

Site History

The historic features at JM155 may be related to the Beebe homestead. Alanson E. Beebe acquired a federal patent for the 160-acre tract containing JM155 when he paid the U.S. Receiver's Office in Lamar, Colorado $600 for the land on April 27, 1889 (Bent County, *U.S. Receiver's Receipts and Patents,* Book 23:6). On April 12, 1889 Alanson Beebe gave Edward Rollins a deed of trust for the property as security for a loan of $70.60 owed to the Rollins Investment Company (Bent County, *Trust Deed*

Record Book 22:225). Alanson E. Beebe then sold the 160 acres to E. H. Rollins and Sons, of New Hampshire, on December 12, 1892 (Bent County, *Warranty Deeds,* Book 25:517).

On September 8, 1893 E. H. Rollins and Sons sold the property to Hiram C. Rider of Arapahoe County, Colorado, for $300 (Bent County, *Warranty Deeds,* Book 53:222). The Bent County Assessment Roll for 1910 showed that Huey used 67 acres of the tract as farmland, and the other 93 acres was utilized for grazing livestock. From the time Huey acquired it, until it was purchased by the United States, this tract shares the same chain-of-title as site JM152.

8.4 SUMMARY

During the cultural resources survey of the John Martin Reservoir Project Area, 34 sites with historic components were located and recorded. These historic components can be grouped into functional categories as follows: 18 farmsteads, five ranch-related remains, 10 trash scatters, and the townsite of Old Las Animas. Almost all of the sites date to the late nineteenth and early twentieth century. Although the literature search and Historical Regional Overview (Section 7.1) indicated that the project area had been part of a major highway and exploration route utilized from the fur trade era to the early ranching period, few remains of early historic sites were found.

The data for the historic sites was presented in a very different manner from the prehistoric sites for this project. In the section above the physical location and archeological description of each site is given, along with a site history. The archival information complemented the archeological evidence, clarifying the chronology and function for the historic sites. This site-specific data will be utilized in the following section (9.0) to answer the questions raised in the research design (Section 7.0), and to provide generalizations about the settlement and demographic patterns within the project area.

SECTION 9.0
ANALYSIS AND EVALUATION OF HISTORIC HYPOTHESES
by Paul D. Friedman

The data collected in the field during the survey was analyzed during the laboratory and write-up phase of this project using quantitative methods. Both archeological and archival information were organized into variables, coded, punched, and analyzed using a computer.

The following section will briefly outline the methods used to program the computer and will discuss the results of the analysis in terms of both the Research Questions (Section 7.2) and the Hypotheses and Test Implications (Section 7.3) for the historic sites.

9.1 METHODOLOGY

The analysis of the historical data was performed using the package programs SPSS and NTSYS run on the CDC Cyber 172 Computer at the University of Colorado, Boulder Computing Center. The data were organized into three general variable groups, or data records. Data Record 1 was site-specific information about artifact categories and site features (Figure 9.1). Data Record 2 was information pertaining to settlement patterns. Data Record 3 examined demographic information. These variables have previously been discussed in Section 7.3.

Using the SPSS analysis, running the subprograms for Frequencies and Crosstabs, the descriptive statistics for the artifact variables were produced. Analysis of artifact patterns by site was accomplished using NTSYS. The frequency percentages of the artifact Group and Class for each site formed the basis of this analysis.

The NTSYS program is an average link and a subsets cluster analysis, using a standard data matrix. An indepth discussion of these techniques can be found in *Principals of Numerical Taxonomy* by R. Sokal and P. Sneath (1963). Figure 9.2 presents the sequencing of the NTSYS subprograms used in this analysis.

The SPSS subprogram for Frequencies listed the variables by raw count, relative frequency (or percent), adjusted frequency, and cumulative frequency. The analysis also included means, medians, modes, range, minimums and maximum values for the applicable variable scales (i.e., interval/ratio scaled variables). This subprogram was run for all data records.

The SPSS subprogram for Crosstabs gives a crosstabulation of frequency percentages of the variables against the site numbers, or other variables. Examples included site by artifact Group, or ownership by decade. The Crosstabs subprogram was used in some cases for Data Record 1 and 2. Figure 9.3 illustrates which programs were used for which variables.

9.2 ADDRESSING THE RESEARCH QUESTION

The Regional Research Questions (Section 7.2 covered such topics as chronology, function, ethnicity, and wealth. The purpose of this section is to address these topics in terms of the data collected from the historic sites located during the John Martin Reservoir Project.

9.2.1 CHRONOLOGY

The historic research questions addressed both historic and archeological approaches to the problem of chronology. In terms of the archeological data, it was discovered that very little information about site or regional chronology came from features or artifacts found on

FIGURE 9.1
SUBPROGRAMS USED TO ANALYZE THE HISTORIC DATA

Data Record No.	Variables	Subprogram
1	Artifact variables	SPSS (crosstabs)
		NTSYS
	Site function	SPSS (frequencies)
	Location	SPSS (frequencies)
	Site components	SPSS (frequencies)
	SCS Range Site No.	SPSS (frequencies)
	Distance to permanent water	SPSS (frequencies)
	Number of artifacts	SPSS (frequencies)
	Site features	SPSS (frequencies)
2	Decade	SPSS (frequencies)
	Number of times sold	SPSS (crosstabs)
	Ownership	SPSS (crosstabs)
	Size of land holding	SPSS (crosstabs)
	Assessed value of the land	SPSS (crosstabs)
	Longest time in one family	SPSS (frequencies)
	Year of patent	SPSS (frequencies)
3	Sex and marital status	SPSS (frequencies)
	Number of children	SPSS (frequencies)
	Age	SPSS (frequencies)
	Ethnicity	SPSS (frequencies)
	Place of origin	SPSS (frequencies)
	Occupation	SPSS (frequencies)
	Number of adults	SPSS (frequencies)

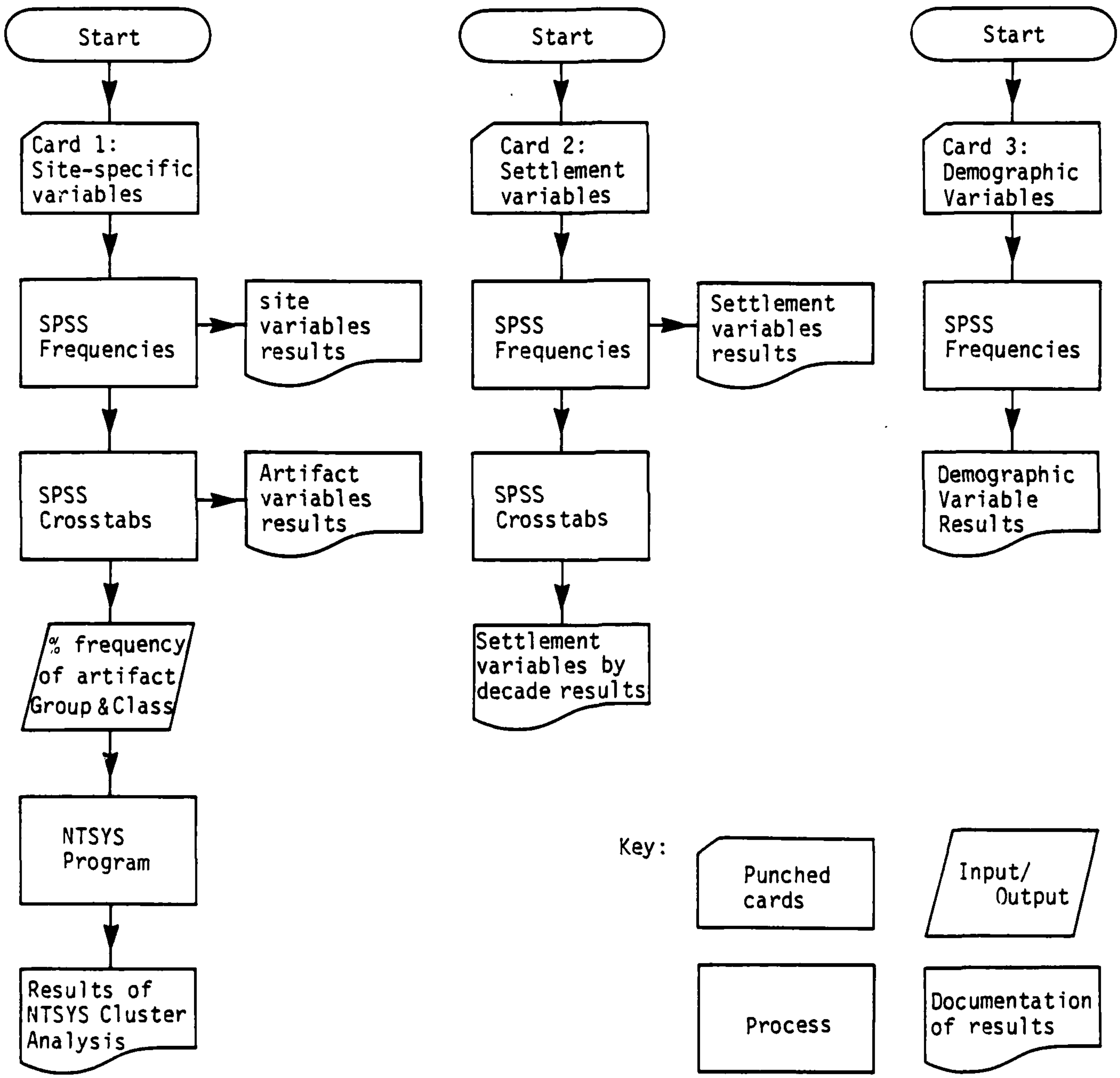
FIGURE 9.2
SEQUENCES FOR NTSYS SUBPROGRAMS FOR HISTORIC DATA RECORD

Subprogram	Function
Files	Designates program and data system files
Format	Input format
Stand	Standardization of input data
Simint	Quantitative similarity matrix of correlation coefficients using standarized data
Taxon	Using average link cluster analysis (unweighted pair-group method of association) produces phenogram from similarity matrix
Mx comp	Produces correlation coefficient for representativeness of phenogram from similarity matrix
Subsets	Subsets cluster analysis from similarity matrix

FIGURE 9.3

FLOW CHART DIAGRAM OF COMPUTER ANALYSIS OF THE HISTORIC DATA

JOHN MARTIN RESERVOIR PROJECT



the ground. Because of the "modified no pick-up" collection policy it was not possible to study historic artifacts in the laboratory to determine their chronological attributes. The information recorded on the site mapping forms indicated, however, that in general most of the artifacts from the historic sites appear to date from the late nineteenth century and early twentieth century. These dates are too broad to have any meaning in terms of settlement patterns or site-specific dates of occupation, although they do agree with the known historic information about settlement patterns for this region.

It was the archival data, rather than the archeological information, which best answered the questions about chronology for the John Martin project area. The general regional trends have been discussed in the Historic Regional Overview (Section 7.1). The present section will deal with information acquired from site-specific historical research. Questions concerned with historic sites chronology for the John Martin Project have been answered using the date of patent of the land containing the site as the best indication of the initial date of occupation for that site. All of the historical sites recorded during the project date to the Euro-American period, and it was discovered that 31 of the 34 sites were located on land that had been patented.

The analysis of the patent dates for the historic sites within the John Martin Reservoir project area showed that the vast majority of sites were occupied between 1880 and 1930. The earliest date for a patent was 1878, and the latest was 1923. The mean date of patent for all of the historic sites was 1902. There seems to have been two major periods of settlement in the project area. The first was the decade between 1880 and 1890. Eleven sites, or 35% of the total, were patented in this period. The second period of historic settlement was between 1910 and 1920, when nine sites, or 29% of the total, were patented. This information corresponds to the regional trends for the project area. As the historical overview has shown, homesteading in the project area began in the1880s when the breakup of the large open-range cattle ranches and the promotion of the railroads encouraged small ranchers and farmers to settle in this region.

There was no significant difference between the average date of patent for sites on the south side of the Arkansas River as compared to sites on the north side. Both had mean dates of 1902. This was somewhat surprising in light of the historical evidence that the earliest ranches were located on the south side of the river, and that the occupation of the north side occurred at a latter date. The fact that this was not statistically revealed may be explained by the fact that the early ranches were located in the river bottom, and the filling of the reservoir covered these sites so they could not be recorded during the survey and, therefore, would not have been part of the data base.

There was also no significant difference between the average date of patent for sites of different function. The mean date of patent for farmsteads was 1902. The mean for trash scatters was 1901. The mean for ranch-related (nondomestic) sites was 1903. The specific dates of occupation for individual sites can be found in the section on Historic Data (Section 8.0).

9.2.2 FUNCTION

The assignment of functional attributes to the historic sites located during the John Martin Reservoir project was based almost strictly upon the archeological evidence. A site with residential foundations was called a farmstead. A feature that was obviously related to some aspect of ranching or farming, such as a dam, or fence, or water trough, but with no evidence of domestic habitation, was called a ranch-related site. Domestic artifacts not associated with any features were called trash scatters. The location of

Old La Animas was noted as a townsite.

During the John Martin Reservoir project, 34 sites with historic components were located and recorded. Eighteen of those sites were labeled farmsteads, 10 were trash scatters, 5 were ranch-related, and 1 was a town. The fact that 68% of all the historic sites located during the project were either farms or ranches indicates that stock raising and agriculture were the major activities for the region. This again corresponds to the known historic regional trends. With the decline of the open-range cattle industry in the late 1880s, small-scale stock raising and farming became the predominate industries in the area, and have remained so to this day.

9.2.3 ETHNICITY

There was virtually no obvious archeological indications that certain sites were occupied by certain ethnic or cultural groups. The pattern of features and artifacts at all of the historic sites appeared to be similar, and none stuck out as following a different pattern that could be associated with specific cultural affiliations. The only data on ethnicity which was acquired during the project came from the examination of the U.S. Population Census sheets for the towns of Old Las Animas and Old Caddoa. It has been assumed that the population of the rural countryside was similar in composition to the towns. This assumption is strengthened by the fact that almost half of the adult males in both Old Las Animas and Old Caddoa were occupied in agricultural pursuits.

In the federal census of 1880, there were 103 people listed as living in the "village of Las Animas." Of these, 68 (or 66% of the total population) were adults over the age of 16. A closer examination of the population of this town revealed that 88.2% of the adults were white, 8.8% were Black, and 2.9% were Hispanic. The vast majority of the town was American-born (78%). The only significant foreign-born group came from Ireland, and they represented 18% of the total adult population of the town. There was one person from France and two from Germany living in Las Animas in 1880.

The census data for the original town of Caddoa in 1900 shows some similar ethnic trends. Of the adult population, 76% was white, and 24% was Hispanic. There were no Blacks living in Caddoa. Almost all of the Hispanics came from New Mexico. Therefore, native-born Americans represented 97% of the total adult population of the town. Of the 3% who were foreign-born, two individuals were from Mexico, one from Ireland, and one from France.

What the census data for both Old Las Animas and Old Caddoa showed was that the area was fairly honogeneous, being made up almost entirely of white, native-born Americans. The Black population in Las Animas in 1880 (six adult individuals) can be attributed to the presence of Black cavalry troops at Fort Lyon. Frederick C. Luebke, in the introduction to this edited reader entitled *Ethnicity on the Great Plains*, pointed out that Blacks first became aware of the region while serving in the military. Some Blacks stayed in the area, and found employment on ranches as cowhands and cooks. Such was probably the case with William Hill, a 28-year-old Black man from Kentucky, who was listed as a sheepherder living in Las Animas in 1880. Luebke dates the first significant Black settlement of the Plains to around 1879 when thousands of former slaves moved into Kansas from the South. However, not many homesteaded in the western portion of that state, or in eastern Colorado. The circumstances of their presence in the region tended to discourage fruitful family life and permanent residence. It is interesting to note that four of the six Blacks listed as living in Las Animas were single women, with children. Their lack of commitment to the area is reflected in the fact that no Blacks

were listed as residing in Caddoa in 1900. Prejudice towards Blacks was commonplace, and may have contributed to this. One incident was recalled in Luke Cahill's (1923) memoirs where a racial slur touched off a fight in a bar in Old Las Animas between some Black cavalry troops and white cowboys. (See the history of Old Las Animas in Section 8.0).

There was a significant number of Irish-born people living in Old Las Animas in 1880, but almost none in Caddoa 20 years later. This may have meant that they too were only a transitory group in this region. The presence of Irish in Old Las Animas was probably related to railroad construction and service in the military at Fort Lyon.

The only other prominent ethnic group in the project area were the Hispanics. They do not show up in the census as foreign-born, since the majority of them migrated to eastern Colorado from New Mexico. They did not make up an important part of the early population of the region, as the fact that only two lived in Las Animas in 1880 shows. However, by 1900 they had arrived in the area in significant numbers, with 35 individuals residing in Caddoa out of a total adult population of 152. The Hispanics worked mainly as sheepherders and railroad construction hands. This group of native-born Hispanics who arrived in southeastern Colorado at the end of the nineteenth century must be distinguished from the later migration of agricultural laborers who have come up from Mexico during the last 50 years.

Looking at the distribution of foreign-born people in the Great Plains, it is clear that southeastern Colorado is different from the rest of the region, having a much higher percentage of native-born residents. For Colorado as a whole in 1880, some 21% of the people living in the state were foreign-born. Old Las Animas at this time had a similar population, 22% being of foreign birth. However, 20 years later 17% of the population of Colorado were of foreign extraction, while in Old Caddoa in 1900 only 3% were foreign-born. Luebke (1980) recognized this trend. He stated that ethnic groups were more prominent in the mountain mining camps of Colorado, while they were less numerous on the High Plains, averaging between only 5 and 10% of the population. However, he does not explain why this trend occurred.

The last ethnic group which must be addressed are the Volga Germans. These people were prominent in Nebraska, and other historical sources (Markoff 1978) indicate that a significant number of Volga Germans migrated into the Arkansas River Valley to farm sugar beets. However, since this migration was tied to the construction of sugar beet factories in the area after 1900, it is not surprising that few Germans show up in the census before that date. The manuscript census sheets which were used for this analysis only go as far as 1900.

9.2.4 WEALTH

Questions concerning wealth proved difficult to answer. It was not a topic which could be directly addressed through the archeological data. Although some sites had denser artifact scatters than others, most of the artifact types were similar for all of the sites recorded. It was possible to address questions concerned with wealth through the historical record. The Bent County Assessment Rolls provided information about the size of a landholding and the assessed value of that land. Thus it was obvious that some landowners were wealthier than others. Unfortunately, it was not possible to directly correlate the wealth of the landowners with the archeological sites. For example, JM002 was a trash scatter not related to any domestic

occupation and with no indications of wealth associated with the kind of artifacts found there. Yet if this site was judged on the wealth of the property owner, it would have to be categorized as a "wealthy" site, since the owners were a prominent ranching family who owned a great deal of land.

Another way to address wealth is on a regional, instead of a site-specific, level. It was decided that the average assessed value of a tract of land in the project area might give some indications about wealth over time. For example, in 1890 the average tract of land was 195 acres in size, and the average assessed value of the land was $610, for an average worth of $3.1 an acre. In 1900 the average tract was 218 acres and the average assessed value was $567, or $2.6 an acre. In 1910 the average landholding covered 802 acres and was assessed at $2,635, or $3.2 an acre. The first noticable jump in property values occurred in 1920 when the average 906 acre tract was assessed for $10,010, or $11 an acre. In 1930 there was a slight decline in the average price per acre, as the average tract of 1,365 acres assessed at $12,540, or $9.1 an acre.

Land values appeared to have been fairly constant up until the decade between 1910 and 1920. The fact that a big jump in property values occurred at that time may have several explanations. One is that this was a period of great agricultural prosperity throughout the entire country, and this prosperity obviously carried over to the project area. With the increase in the value of agricultural products came an increase in the value of agricultural land. The drop after 1920 is probably related to the end of that prosperous period.

9.3 ADDRESSING THE RESEARCH HYPOTHESES

The Hypotheses and Test Implications presented in Section 8.3 of this report attempted to focus attention upon such topics as settlement patterns, land use, demographic change, environmental factors, and material culture. The following section will deal with these topics in terms of the quantitative analysis of data acquired during the survey.

9.3.1 SETTLEMENT PATTERNS

One of the research hypotheses for settlement patterns stated that it was expected that most of the homesteads in this region were patented relatively late, probably between 1880 and 1900. The analysis of the 31 historic sites which had been patented proved this hypothesis to be correct. Forty-eight percent of all the historic sites were on land patented between 1880 and 1900. The mean date of patent for all the sites was 1902. The result of the analysis of the patent data has already been discussed at some length in the section on Chronology (9.2.1).

The second research hypothesis on settlement patterns stated that a few people would control most of the land in the project area. The data analysis proved this hypothesis to be partly incorrect. Although the presence of large ranching outfits like the Prairie Cattle Company in the region during the 1870s and 1880s gave the impression that these big companies must have controlled most of the land, this impression was false. Early assessment tract maps indicated that the Prairie Cattle Company only owned land near the river and, in fact, ran most of their cattle on public domain. When homesteaders began settling this region in significant numbers after 1880 they took up small tracts of land, and the local assessment tract maps show many different owners controlling relatively small parcels. In 1890 the average landholding was only 195 acres. By 1900 it had grown a little to 218 acres. By 1910, however, the size of an average tract of land in the project area had jumped to 802 acres. The size of the average landholding continued to grow over time,

reaching 906 acres in 1920 and 1,365 acres in 1930. Of course, as the size of the average landholding increased over time, this concentrated the control of land into the hands of a smaller number of people.

It was not surprising that the average tract of land increased in size as time went on. This trend is probably directly related to economic necessities. In the semiarid plains more land was required to successfully operate a farm or a ranch than in humid regions. This trend toward the increase in the size of landholdings has been observed by other scholars studying agricultural patterns on the Great Plains. Mary Hargreaves (1957), for example, noted that mechanization of farm equipment lead to an increase in the average farmholding on the northern Plains. In North Dakota average landholdings rose from 382.3 in 1910 to 466.1 in 1920. Thus, the John Martin project area followed a pattern found all across the plains.

The next research hypothesis stated that a significant number of acres would be controlled by out-of-state investors. Again, the data available indicated that this was not exactly the case. Between 1890 and 1900, 87.5% of all the sites were located on land owned by Bent County residents. Between 1900 and 1910, 100% of the land was locally owned. From 1910 to 1920, 93.3% of the land was owned by people residing in Bent County. Only from 1920 to 1930 were there a significant number of nonlocal owners, as 20.8% of the sites were in the hands of people who did not live in Bent County. Between 1930 and 1940 the trend for outside ownership increased, as 34.6% of all sites were controlled by nonlocal owners.

From 1890 to 1920 virtually all of the land in the project area was owned by local residents. Between 1920 and 1940 this began to change as people from outside Bent County began to acquire property within the project area in increasing amounts over time. It should be pointed out, however, that the majority of these outside investors resided within the state of Colorado. Also, that although outside ownership was increasing, in the last decade, from 1930 to 1940, 65.3% of the land was still locally owned.

Another research hypothesis dealt with land tenure. It stated that a significant percentage of land remained in one family for a long time and that the average rate of turnover was low. The analysis of the data from the historic sites supports this hypothesis. For each site that was researched, the longest time it was held by any one family was determined. The shortest time for any site owned by a single family was nine years. The longest was 48 years. The mean for all 31 sites that were researched was 25 years. This shows amazingly long tenure within a single family when it is considered that the average date of patent for all sites was 1902 and that the federal government began acquiring property for the reservoir between 1938 and 1942.

Another way to judge land tenure is to examine the average number of times a piece of property was sold over time. Between 1890 and 1900, 60% of all tracts were sold less than twice, and 80% less than three times. From 1900 to 1910, 83% were sold less than three times. Between 1910 and 1920 77.7% of all landholdings studied were sold less than twice and 88.8% less than three times. From 1920 to 1930 some 53.3% of all property were sold less than twice, 80% less than three times. Between 1930 and 1940 84.1% of all sites were located on property sold less than twice. Looking at the period as a whole, it was discovered that in the 38 years between 1902 (the mean date of patent) and 1940 (the date the U.S. began to acquire the land) the average site was sold five times. Often these sales took place within a single family, a father selling to a son. This is substantiated by the fact that in the same 38-year period for the average length of

occupation, one family held the land for 25 years, on average.

What the figures on the number of times a piece of property was sold per decade show is that this was a very stable region in terms of land tenure. No single decade showed any dramatic changes. There was no trend that indicated that people were selling their land more often at one particular time. For every decade, well over 80% of all sites were sold less than three times. The only surprise was the period between 1930 and 1940 when it was expected that the conditions of drought and the Great Depression might have lead to an increase in the sale of property. In fact, this was an exceptionally stable period in terms of land sales, 84% of all sites being sold less than twice.

9.3.2 LAND USE

Several of the research hypotheses dealt with the subject of land use. One stated that most of the land was used for ranching or farming, with ranching decreasing over time and farming increasing. In fact all of the historic sites were located on agricultural land that had been used for either farming or ranching. There was no way to determine if one activity had increased over time while another had decreased. For example, local assessment rolls indicated that site JM029 was operated mainly as a farm in 1910, and mainly as a livestock ranch in 1930. In examining 31 of the historic sites it was found that 16, representing 52% of the total, were listed as being located on grazing land. Four sites, or 13% were listed in the assessment rolls as being located on irrigated agricultural farm land. Eleven sites, or 35%, were part of multiuse complexes, or land that was utilized for both ranching and farming.

Another research hypotheses asked if the kind of sites which were located during the survey reflected land use in the area and corresponded to the historical information. This definitely proved to be true, as 68% of all the recorded sites were either farmsteads or ranch-related features.

The last research hypothesis dealing with land use was aimed at determining whether occupations in town (i.e., Old Las Animas and Old Caddoa) reflected the rural economic base. It was discovered that they most certainly did. For Old Las Animas in 1880 the census data revealed that 48% of all adult males were occupied in some agricultural related business. This would include ranchers, cowhands, farmers, farm laborers, and sheepherders. Old Caddoa in 1900 had some 39% of the adult male population involved in an agricultural occupation.

9.3.3 DEMOGRAPHIC CHANGE

Using the data acquired from the U.S. Manuscript Population Census sheets for Old Las Animas in 1880 and Old Caddoa in 1900 it was possible to trace changes in the makeup of the population of the region over time. The first research hypothesis dealing with demographic trends stated that there was no significant Euro-American population in the project area prior to 1870. This is true. The 1870 census counted only 137 dwellings and 592 people as living in Bent County. The first survey of the county, made by George Hill in 1871 showed only 13 ranches in the entire project area.

The second research hypothesis on demography stated that the population of the region increased after the decline of the range cattle industry and the arrival to the railroad. While it is true that those factors influenced settlement in the project area, it should be pointed out that as a rural region there was never any spectacular increase in the size of the population of the area. In 1890, for example, the census showed that the Bent County population had grown to 1,313 people.

The third demographic hypothesis predicted that many of the early settlers of the region were white Americans from the Trans-Mississippi states. In 1880 Old Las Animas had a population that was 88.2% white, and 78% American born. However, these people did not come from the Trans-Mississippi West. Only 13% of the adult population came from states located west of the Mississippi River. In fact, the majority of adult residents of Old Las Animas came from the East and mid-West; 16.2% came from Pennsylvania alone.

The next hypothesis dealt with the sexual composition of the towns. The old frontier theory is that the West was settled by single young men. Later, however, the number of women and children would increase with time. The census data would seem to contradict this theory. It appears that women and children made their presence felt in these towns from the very beginning. In 1880 Old Las Animas had 26 women (38% of the total population) and 35 children (or 44% of the total population). In Caddoa in 1900 women represented 27% of the total population, while children accounted for 32%. So for both towns, women and children made up well over half the population. This does not mean that there were not a significant number of single young men in these towns. Of the total adult male population of Old Las Animas in 1880, some 60% were single, never having been married. In Caddoa in 1900 single men represented 64% of the total adult male count. Nevertheless, marriage was an important institution and both towns showed the strong influences of family life. In Old Las Animas 38% of all adult men were married. For women the ratio was even higher, 54% having spouses. Old Caddoa had similar statistics. In 1900, 34% of all men, and 90% of all women were married.

It should also be acknowledged that both Las Animas and Caddoa were young towns in the typical frontier mold. The average age of an adult living in Old Las Animas in 1880 was 29 years old. Sixty-nine percent of the total adult population was between the ages of 16 and 30 years old. The trend was similar for Old Caddoa in 1900. The mean age was 32 years old, and 56% of the adult population was 30 or younger.

The next hypothesis attempted to deal with occupations. It has already been pointed out that a significant percentage of men were engaged in agricultural in both Old Las Animas and Old Caddoa. It should also be pointed out that the railroads employed a number of men in both towns. Twelve percent of the adult male population of Old Las Animas worked for the railroad in 1880. In Caddoa in 1900 the railroad played an even more important role, employing 31% of all adult men. Women tended to stay home, out of the job market, and it was most common to see the words "keeping house" next to a woman's name in the census sheets for both towns.

It has been a fairly regular procedure for social and urban historians to discuss occupations in terms of economic divisions of labor and social stratification. It was possible to also examine the work force of Old Las Animas in that light. It was discovered that 48% could be classified as unskilled and semiskilled labor. This category included such jobs as farm laborer, day laborer, cattle herder, and railroad section hands. Fourteen percent of the adult male population of Las Animas in 1880 were employed in skilled labor positions. This would include blacksmiths, wheelwrights, teamsters, and carpenters. The last classification was the entrepreneurs, businessmen, and professionals. This category included farmers, ranchers, merchants, teachers, and saloon keepers. Thirty-two percent of the adult male population fell into this category.

In comparison, Caddoa in 1900 had 59% of its adult male population classified as unskilled or semiskilled labor. Thirteen percent could be

called skilled labor. Only 19% fell within the entrepreneur and professional class.

9.3.4 ENVIRONMENTAL FACTORS

Some of the archeological variables for the research hypotheses dealt with the influence of environmental factors on historic site locations. What is the correlation between site location and distance to permanent water or site location and soil type? Do certain site types exhibit similar relationships to these environmental factors? As far as distance to permanent water is concerned, only ranch-related features were located very near water, a mean of 275 m. This was to be expected because some of those features were water troughs or dams. Farmsteads had a mean of 1,174 m to water. Trash scatters averaged a distance of 1,320 m. Strangely, farmsteads did not appear to be located in the best environmental settings. The majority of ranches and farms turned out to be located in some of the poorer soil area. Over 41% of all the farmsteads were found within SCS Range Site 6, which had one of the lowest mean annual plant production ratings. Twenty-nine percent of all farmsteads were located within SCS Range 19, also a low yielding soil area. Ranch-related sites were found to be located either within Range Site 6 (60%) or Range Site 53 (40%). Interestingly enough, the strongest correlation between site types and SCS range site locations were the trash scatters, 73% of which were found in Range Site 64. However, since trash scatters were not occupation sites, this correlation has little meaning in terms of factors which would determine where people settled. From the evidence at hand it appears that neither distance to permanent water or soil types played a major role in the location of historic sites within the John Martin Reservoir project area. It is suggested that perhaps unquantifiable variables, like esthetics, protection from the wind, and access to water through a well or cistern played important roles in the decision concerning the location of a farmstead.

There was also an attempt made to examine whether site types differed between the north side of the Arkansas River and the south side. Fifty-three percent of all historic sites were located on the north side, and 47% on the south. Looking just at function, 61% of all farmsteads were found on the north side of the Arkansas River, as were 70% of all trash scatters. This is a little surprising in light of the evidence that most of the early ranches were established on the south side of the river, where the soil appears to be better for forage.

9.3.5 MATERIAL CULTURE

An effort was made to examine both intrasite and intersite patterns in the distribution of artifactual remains. Unfortunately, the results of the analysis did not produce a clear breakdown of artifact patterns within sites. There was some useful data on intersite patterns, but the results are somewhat obscure and difficult to interpret.

As explained in Section 7.3, artifacts were classified for the analysis in terms of their attributes. Specifically, they were separated into categories labeled Group, Class, Type, and Ware. The percentage frequencies of the Group and Class categories for each site was then run through an NTSYS computer program to examine the relationship between sites. The program grouped like sites together according to the level of association derived from the artifact percentage frequencies. A phenogram was produced which graphically illustrates the groupings of sites (Figure 9.4).

The phenogram showed that the historic sites basically fell into three groups of associations. None of these groups has very strong or clear functional relationships. The first group consists of site JM001, JM131, JM119, JM121, and JM127. These are all either farmsteads or ranch-related sites, and their artifact patterns, influenced by mechanical types, best reflected

their use as farms and ranches. The second grouping consisted of JM002, JM006, JM018, JM039, JM029, JM155, JM040, JM069, and JM083. Of the nine sites in this grouping, five are trash scatters and four are farmsteads. Since the trash scatters were predominately domestic artifacts, it appears that the farmsteads in this category had more domestic kind of artifacts than mechanical artifacts. This grouping reflects the influence of domestic habitation and domestic refuse more than it does the functional attributes associated with the operation of farms and ranches. The third group consists of JM003, JM004, JM025, JM020, JM065, JM120, JM055, JM043, JM071, JM078, JM105, JM153, JM152 JM111. Of these 14 sites, 8 were farmsteads, 5 were trash scatters, and 1 was a town. This category reflects the general domestic nature of the farmsteads, which is similar to some of the trash scatters. The town site of Old Las Animas also had a similar pattern of domestic refuse disposal.

9.4 SUMMARY

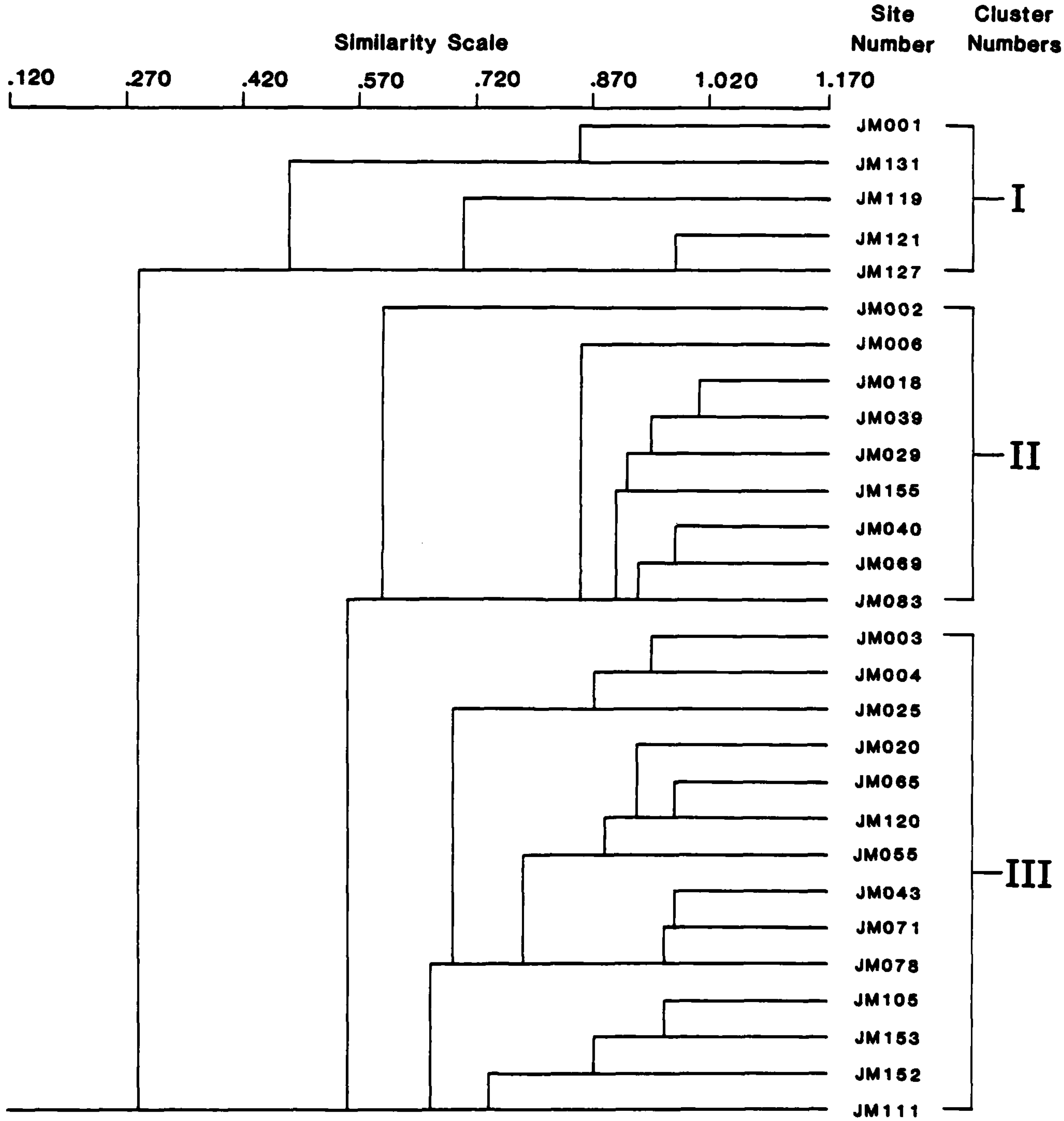
The historic data were investigated by means of quite different research procedures than was the case for the prehistoric analysis. These included a mix of archeological field observations coupled with a search of the archival records pertinent to the individual historical components. The quantifiable data, such as artifact frequencies, site features, settlement, and demographic information, were analyzed quantitatively by three SPSS programs: Frequencies, Condescriptive, and Crosstabs. In addition, an attempt was made to investigate function by clustering sites by artifact content using the program NTSYS.

From these analyses, it can be said that the analysis of the historic data has allowed for some generalizations to be made about the history of settlement and occupation of the John Martin Reservoir project area. First, this region was mainly settled by Euro-Americans in significant numbers after 1880. These people, the majority of whom were white, native-born Americans, came to the area and established homesteads. These homesteads tended to be either small livestock ranches, farms, or multi-use farmsteads where both crops and livestock were raised.

This was a fairly stable rural region. Land usually remained in the hands of one family over a long period of time and was sold relatively infrequently. Almost all of the land in the project area was in the hands of local people, although the percentage of outside ownership did increase over time. Most homesteads started out small in size, but they tended to increase over time as the economic necessity of farming or ranching large tracts forced some small landowners out, and gave others the opportunity of expanding their acreage.

The data acquired during the cultural resources inventory of the John Martin Reservoir will only have real meaning when it can be compared to similar kinds of studies. Unfortunately, historians and archeologists are only beginning to touch upon many of the topics which were examined during this project.

FIGURE 9.4
NTSYS ANALYSIS OF HISTORIC SITES
JOHN MARTIN RESERVOIR PROJECT



SECTION 10.0
SUMMARY AND CONCLUSIONS

by Frank W. Eddy and Paul D. Friedman

Four topics will be discussed in this section. They are the evaluation of the research design, the summary of the study results, the conclusions and directions for future research, and the management recommendations. The first three topics are separated in terms of the prehistoric and historic components of the study. The fourth topic, management recommendations, will be combined as a summary of Section 11.0, Site Management Data.

10.1 EVALUATION OF THE PREHISTORIC RESEARCH DESIGN

The prehistoric research design is presented in Section 4.0 of this report. This design was based on the Methods of Hypothesis Testing. This method uses a set of problem orientations discussed in terms of theoretical biases, hypotheses, test implications, and research methods employed to answer the questions.

The prehistoric study was based on two research propositions which concerned settlement variability: one functional and the other evolutionary. Fourteen derivative hypotheses were obtained: six functional and eight evolutionary. Each hypothesis in turn was rewritten as a series of numbered test implications, whereby, the hypothesis could be accepted or rejected. This process was operationalized using quantitative measures (59 variables) which were manipulated by statistical tests. The statistics were as follows: univariate, bivariate, and multivariate procedures written in a computerized format called SPSS. In addition, original Nearest-Neighbor computer programs were written by R. Oberlin of SAI in order to analyze the spatial distributions of artifact and site data. Another distributional analysis consisted of the Z-coordinate cluster mapping. A final analytical approach was the adoption of NTSYS for the establishment of the functional site typology and intrasite comparisons of artifact clusters.

The important question to answer is to what degree was the Method of Hypothesis Testing a useful approach to archeological research in southeastern Colorado and the John Martin Reservoir Project in particular? On the positive side is the focus provided by a deductive design. It absolutely demands a tightly formulated research problem, which then dictates the manner of recording data and procedures for analysis. In this study, it meant that we would collect distributional data in the field by piece plotting each artifact. As a compromise, we recorded small sites as a census enumeration of artifacts and used a block sample of 100 records for large sites. In this way, we were able to examine the functional hypotheses both in terms of intrasite artifact clustering and intersite cluster groupings: a distributional approach leading to task-activity and community definitions.

On the negative side, it is apparent that the Method of Hypothesis Testing works best when considerable research has already been conducted in the area. With the previous research available, more reliable predictions can be made with a reasonable chance of recovering the pertinent data for their evaluation. In this study, the evolutionary hypotheses was difficult to support because we simply did not encounter the necessary chronological evidence needed to date most of the sites. Instead, the field recordation led us to conclude that the time-sensitive artifacts had been systematically pilfered, leaving us with an unreliably small

sample of 11 sites (11.1% of the computer data file) for testing of the evolutionary hypotheses. Further, most of these sites were dated by only one or two projectile points and/or potsherds.

The situation is similar for the functional hypotheses. We had hoped to divide each time period for functional analysis, but this was impossible because there was not a strong temporal control. Instead, the prehistoric sites were collapsed for purposes of analysis. Some justification for this procedure is provided by the comparatively short time span (late Archaic through protohistoric periods) on most of the data. However, the lack of chronological control remains one of the greatest problems in this investigation.

10.2 SUMMARY OF THE STUDY RESULTS

The study results summarized here are taken largely from Section 6.0, Analysis and Evaluation of Prehistoric Hypotheses.

The univariate analysis was performed on 50 quantified variables to establish the basic statistical parameters such as mean, range, minimum value, maximum value, and dispersion. Nominal and ordinal scales were examined for frequency by observational category. For this examination, the basic descriptive behavior of each measure was determined. In the case of most of the interval level variables, it was determined that they behaved as a reasonably normal distribution.

When the analysis had advanced to a bivariate or paired treatment of variable sets, quite useful functional conclusions were obtained. Specifically, two generalized site types were defined: base camps and special-activity sites. Scattergram correlation statistics allow us to say that base camps were large in size, had many fire hearths, and a wide range of tool types with high frequencies of hammers, metates, manos, and tertiary flakes. Further, these sites were found at low elevation, at some distance from intermittent drainages, close to permanently flowing water (Arkansas River or Rule Creek), centrally located within a SCS range site habitat and away from the ecotonal boundary, where the vegetative productivity is high (high-standing crop yield). These empirical relationships suggest that base camps were the sites of a wide range of activities. Permanent potable water was nearby, large-seeded grasses were harvested from the nearby stabilized dune fields and milled into meal for hearth-baked cakes, and stone tools were finished and maintained. Correlation and association statistics run on the ordinal and nominal data enlarge this picture of base camps. They allow us to say that the riverside base camps were sites of riparian hunting of deer, bison, elk, and waterfowl.

The contrastive picture of site type is the special-activity site. This type of site is small in size, has a low artifact diversity, and a low number of fire hearths. These sites are located at high elevations close to intermittent drainages, far from the perennial drainage of the Arkansas River and Rule Creek, close to an SCS range site boundary, and near the conjunction of many range sites with high ecological diversity. These sites appear in high density clusters and are favored by choppers, bifaces, projectile points, utilized flakes, cores, primary flakes, and secondary flakes. From this data, it appears that special-activity sites functioned as primary lithic procurement (terrace collection of raw materials) and early-stage lithic reduction areas. They also were collecting stations for procurement and heavy-duty processing of vegetal resources. Further, the picture of functional activities is enlarged through the correlation and association statistics run on the game ratings. From this analysis, it is learned that special-activity sites were hunting camps for antelope, jackrabbits, cottontails, and upland game birds.

It is interesting that these empirically derived functional site types are somewhat at variance with the predicted relationships between site type and landscape as described in Hypotheses 1.1 and 1.2. Originally, it had been proposed that the special-activity sites would be associated with a range site habitat, while the base camps would favor the ecotonal boundary between many range sites. This was expected because base camps would need a diversity of resources to maintain an aggregation of the entire community during the season of coalescence of the social band. In contrast, it was predicted that the special-activity sites would favor only one range site habitat to maximally exploit a limited number of resources. But in fact the empirical modeling of site types shows just the opposite set of relationships. Base camps are centrally located with regard to the range site, while special-activity sites show high ecological diversity favoring the ecotonal boundary between and among many contiguous habitats.

From the Z-coordinate mapping of the sites, it was learned that they show internal clustering of artifacts. These Nearest-Neighbor results were compared, one cluster to another, using the NTSYS program. Here it was discovered that some of the intrasite artifact clusters are duplicates, while others are significantly different from one another. Originally, it was hypothesized that special-activity sites would show more artifact cluster duplicates due to annual revisitation, whereas the base camps would express more artifact cluster differentiation as a result of segregated task-activities. However, testing of these hypotheses did not allow their substantiation; the distribution of cluster duplicates/diversity does not show a convincing correlation by site type.

Still further refinements were made in our functional conclusions through multivariate analysis. Clustering of the sites led us to define seven numbered site types (No. 1-7). These are considered to have functional significance since the site classification was based on the artifact frequency content of each site. When the tool classes loading on each NTSYS type were plotted, it was apparent that Site Types 6 and 7 are the base camps while Types 1-5 are the special-activity sites. Next the site types were plotted on a reservoir topographic map. It was found that the base camps strongly favor the south bank of the river where they show close proximity to the stabilized dune fields (Range Sites 19 and 22), while the special-activity sites favor the north bank of the Arkansas. Refinement was made in these distributional plots by running a Nearest-Neighbor analysis on the UTM location of each site entered in the computer file. From this analysis it was learned that the north bank special-activity sites cluster into four sets while all of the south bank base camps are grouped together. However, their mapped distribution shows that base camp site Type 7 is mostly confined to the bank of the river lying between the mouth of Rule Creek and the damsite abutment, whereas base camp site Type 6 lies mostly in Rule Creek. From these geographical and typological relationships, we constructed a second order approximation to the settlement organization of the research district as diagrammed on Figure 6.7. In conclusion, a single complexly organized community is defined reflecting a seasonal dispersal pattern in which base camps were occupied during the fall and winter, while the various special-activity site clusters were visited during the spring and summer.

An additional multivariate analysis was conducted using the program called REGRESSION. The purpose here is to meet a contractual obligation for site-predictive modeling as covered by Hypothesis 1.6. The expectation is that environmental variables were included in prehistoric decision-making processes such that functional site types will be located on the landscape according to land use needs. Twelve

environmental predictors were employed in the Multiple REGRESSION program to predict site density. The results were highly significant Ironically, the predictors clearly indicate that it is the dense aggregates of small special-activity sites located on the north bank of the Arkansas which are being predicted rather than the lower density south bank base camps. As well as serving as a management tool, the predictive REGRESSION model also shows reasonable support for the bivariate settlement modeling. Unfortunately, an attempt to create a complementary regression model for base camps by predicting number of artifacts did not prove significant.

In addition to the functional analyses described above, an attempt was made to grapple with the difficult problem posed by the evolutionary proposition and derivative hypotheses. The underlying assumptions are that sites of the same age will be most alike in formal content as measured by artifact frequency. In contrast, sites of different ages and historical traditions would be most unlike one another as expressed by formal content. When the 11 dateable sites were analyzed by the NTSYS program, it was gratifying to find that indeed eight out of 11 did show the predicted formal clusterings by time period. Thus, the general evolutionary proposition could be upheld even though there was an insufficient number of reliably dateable sites to examine the individual evolutionary hypotheses in detail.

10.3 CONCLUSIONS AND DIRECTIONS FOR FUTURE PREHISTORIC RESEARCH

This section outlines the major conclusions reached by the prehistoric studies. These are followed by a statement as to where research should be directed in the future to advance the front of scientific inquiry.

The main prehistoric theme of this report has been an investigation into settlement variability of the past. This research problem was focused on two aspects of the fossil record: synchronic lifeway variability and diachronic evolutionary variability. Although hindered by a lack of much reliable chronological data, we have still been able to demonstrate significant cultural change in space and time. Particularly, the site classifications affected by the NTSYS analyses has amply demonstrated spatial/temporal patterns in the archeological record to a degree beyond what one would expect given the paucity of dateable sites. Certainly, these results would not have been so marked if the corpus of prehistoric sites had largely dated before 5000 B.P. rather than afterwards. That is Altithermal and earlier environments would have created a landscape without significant analogs with the present, thereby invalidating our research strategy of using contemporary data and, in particular, the SCS range site mapping as a sound classification for predicting archeological site variation.

Beyond these pragmatic conclusions is a more philosophical perspective concerning Colorado archeology. North of the Anasazi Southwest and throughout the state is an uninteresting site type called "Lithic Scatter." This archeological manifestation is nothing more than a spread of stone artifacts; often it lacks any other features such as midden sediments, fire hearths, housing, rock art, or other spicy features. This class of site is the biggest single challenge to the Colorado archeologist. The research question posed by this site type is to what degree does a Lithic Scatter contain any information whatsoever? Often these uninteresting sites have been picked over by collectors for years so that the time-sensitive artifacts (projectile points and perhaps pottery) have been depleted, if there ever were any dateable artifacts. Further, there may have been other forms of disturbing impact such as construction or agrarian development which destroyed or affected the distributional patterning of artifacts comprising the site type. Thus

the first question occurring to the researcher when confronting the ubiquitous Lithic Scatter is to what degree is there any information preserved in this site at all?

The archeology of the John Martin Reservoir project area is predominantly made up of Lithic Scatters. We examined the problem of information content from two standpoints: 1) in terms of the formal content (the list of artifact types and their frequency) and 2) in terms of the spatial distribution of these artifact types. The results of our formal and distributional analyses were most gratifying. We found evidence of formal variability between sites as well as internal spatial variability. Further, this variability seems to make sense when interpreted functionally so that a system of inferences is self-reinforcing with a minimum of discordant conclusions. This internal verification and self-reinforcement certainly heightens the credence of any given conclusion, building a stronger confidence in the whole settlement modeling than would be the case for any one conclusion considered in isolation. The overall assessment that the Colorado Lithic Scatter can be made to yield significant anthropological evidence seems sound. But the investigator must be prepared to expend untold amounts of effort and energy to extract each conclusion; it is not an endeavor for the weak of heart. There are no easy results to be obtained by the fly-by-night scientist.

As for the future, I recommend continued and more refined distributional studies. Particularly, the investigation of internal site patterning needs considerable refinement. A pitfall which we encountered is the lack of consistency in artifact identification. Very tightly defined tool and debitage typologies must be established by reconnaissance study before the full-scale field effort is undertaken. Each field crew must be carefully trained to prevent drift in recording. The shortcomings in the modified no-pickup survey strategy are obvious. If crew-to-crew recording variability exceeds that of the prehistoric functional and temporal variability, the survey results, themselves, become an artifact created by the archeologist. Critics of the no-pick-up survey strategy argue that only laboratory study backup by a permanent museum curated collection is satisfactory (Butler 1979). We counter these claims saying that laboratory analysis is tremendously expensive and time consuming for Cultural Resource Management (CRM) archeology. Further, and no less important, is the fact that our museums are bulging and funds are not available to continue dumping ever larger collections into the already overtaxed system. Furthermore, the no-pickup survey has the advantage of minimal impact on the archeological resource base. Pickup surveys, in contrast, seriously affect the site thereby short-circuiting the NRHP and Section 106 process. The best place to store archeological resources is on the very sites where they were left by their makers. And finally, think of the as yet undreamed-of techniques of data recovery and analysis to be invented by the archeologists of the future. We simply cannot afford to exhaust our resource base today without regard for future generations.

Another sector in the distributional design is that of piece plotting. We used a tripod-mounted Brunton compass with steel tape for quick horizontal measurement. Much more refined accuracy could be accomplished by using a transit or even a theodolite. The computer generation of Z-coordinate maps saves much time in drafting a finished product and combines the advantage of internal Nearest-Neighbor analysis. But better maps can be made and fewer field mistakes must be effected in recording provenience data.

The analysis of the internal artifact clusters has been well accomplished by SAI. However, more must be learned as to why one artifact cluster differs from another and what is being duplicated when the NTSYS program shows that

two artifact clusters are linked at a very high phenon level—that is, are nearly duplicates of one another. Again, Nearest-Neighbor analysis among site clusters must be examined to more objectively define site groups constituting the prehistoric community. To the solution of these and many other unrealized problems, we applaud the future of distributional studies.

10.4 EVALUATION OF THE HISTORIC RESEARCH DESIGN

The historic research design used state-of-the-art techniques to analyze the body of historic information. Both historic and archeological methods were employed in the investigations of the historic sites located during the survey. As much of the archival and archeological data as possible was quantified during the analysis phase. This allowed for both a humanistic and a scientific treatment of the resource base. The humanistic approach is reflected in the narrative histories for the sites. The scientific analysis borrowed concepts pioneered by social and urban historians (Sennett and Thernstrom 1969) for the application of quantitative methods to archival data, and it also took advantage of anthropological approaches to historic archeological sites, as advocated by South (1977) and others (Schuyler 1978). This was one of the few studies to apply both quantitative historical methods and quantitative archeological techniques to the investigation of a fairly substantial geographic region. The historic sites were treated as a block sample for the region, from which generalizations about human behavior in recent times could be developed.

The historic research design sought to use both archival and archeological information to answer the research questions and to test the research hypotheses. The research questions addressed such topics as chronology, function, ethnicity, and wealth. The research hypotheses dealt with settlement patterns, land use, demographic change, environmental factors, and material culture.

Surprisingly, it was discovered during the analysis phase that the most useful data for the examination of those topics came from the archival, rather than the archeological, sources. The date for the patent on the land containing a site was used to answer the question of chronology. The U.S. Manuscript Population Census provided information on ethnicity. Wealth was studied using local county assessment records which had information about the size and value of landholdings. As far as the research questions were concerned, the archeological data was only applicable to the functional labeling of sites.

When testing the research hypotheses, it was also found that the archival data, rather than the archeological, provided some of the best results. Settlement patterns could be studied using the date of patents to see when land was first taken up. The local county assessment rolls provided information about size and value of land. Local deeds indicated land tenure and ownership. Land use was another topic that could be tested with data obtained from the local tax lists. All of the demographic information came from the U.S. Census sheets for Old Las Animas in 1880 and Old Caddoa in 1900. The archeological evidence was used to test the environmental hypotheses and those dealing with material culture.

It was generally the case that the archival data directly addressed the research questions and clearly either supported or refuted the hypotheses. The archeological information proved to be much more ambiguous. The environmental data seemed to indicate that there was little correlation between site function and location and environmental factors. The results of the analysis of material culture was also unclear. There did not appear to be the type of site-artifact patterning that others have

delineated for specific kinds of historic sites (South 1977). Moreover, the NTSYS program did not show any clear clustering of sites by percentage frequency of artifact categories.

In general the research design was very successful. Using the quantitative analysis, generalizations were made about regional trends in settlement and population.

10.5 SUMMARY OF THE HISTORIC STUDY RESULTS

The archeological survey of the John Martin Reservoir project area located and recorded 34 historic components. Of these, 18 were farmsteads, 5 were ranch-related features, 10 were trash scatters, and one was a townsite. These sites were treated as a single data base, and their analysis attempted to formulate generalizations for historic regional trends, based on the information collected during the fieldwork. It was discovered that the area around what is now the John Martin Dam and Reservoir was a rural region which was settled relatively late, after 1880. These people came to homestead small parcels after the breakup of the open range cattle industry and the arrival of the railroads made the region more attractive for permanent settlement by Euro-Americans. The majority of these settlers were white native-born Americans who came from the East and Midwest. They came to this region mainly to start small livestock ranches or farms.

Over time the project area appears to have been a stable region. Most of the families who first homesteaded here stayed for several generations. Ownership of land in the project area was mainly in the hands of local residents. Over time, the size of the average landholding grew, reflecting the necessity of farming or ranching larger tracts to make a profit in this semiarid region. This meant that land became concentrated in the hands of fewer people over time, as those who could not make it work left, while more successful ranchers and farmers increased the size of their holdings.

In spite of both a drought and a depression in the 1930s, local people maintained control of land in this region. During the 1930s most parcels were sold less than twice, indicating that the region was very stable through this period. By the end of the 1930s, however, the Federal Government had announced its intentions of building a dam and reservoir on the Arkansas River and began to purchase land for the project area from private landowners. Thus the historic period of occupation came to an end, and the current land use as a dam, reservoir, and boundary area operated by the COE began in the 1940s.

10.6 CONCLUSIONS AND DIRECTIONS FOR FUTURE HISTORIC RESEARCH

The study of the historic sites in the John Martin Reservoir project area was a fruitful one. It is one of the few examples of both historical and archeological methods being employed in the investigation of patterns of human behavior in historic times for a rural region on a survey level. It has indicated how nineteenth century Euro-American settlers adapted to the environment of the plains, and turned what Major Stephen Long had referred to as the "American Desert" into a productive agricultural area.

Unfortunately, there are few other studies of similar regions with which to compare the John Martin project area. One direction for future research to be urged upon historical archeologists is the kind of multidisciplinary approach to a large geographic region on the survey level. This study has shown that the quantification of archival information can yield important data about Euro-American homesteading, land use, and population change in a rural region like the Arkansas River Valley. This

is an avenue of research which has basically been ignored by historical archeologists.

On a more specific level, the historic sites within the John Martin Reservoir project area, while not significant in terms of the criteria for nomination to the National Register of Historic Places, do represent a data base for future research. One part of the inventory of the reservoir, which was not totally complete, was a more detailed description and analysis of the patterns of material culture in Euro-American farmsteads. Should a selected number of farmsteads be surface collected, and archeologically tested for subsurface remains, the artifacts could then be analyzed in the laboratory in terms of type, ware, group, date, and place of manufacture. Questions about the importation of material goods, intersite differences in artifact use, and self-sufficiency vs. dependence upon a national market, are some of the topics which could be dealt with in a more detailed study.

The above suggestions should be considered pure research goals, and not part of the federally mandated inventory process. They are merely the kind of studies that could be done if mitigation programs were necessary, or if one wanted to further explore historic topics related to this region. It should be made clear that the SAI inventory, while it did not address all possible topics, far exceeded the bounds of most Class III surveys. Management-wise, no further historic work needs to be done in the John Martin Reservoir Project Area, with the exception of dealing with Old Las Animas (JM043) and the town of Caddoa, should it ever appear above the surface of the lake. The SAI survey was more than adequate for the identification of all of the historic sites within the project area and their evaluation in terms of eligibility for nomination to the NRHP.

10.7 MANAGEMENT RECOMMENDATIONS

Three management recommendations are made in Section 11.0, Site Management Data. These are: 1) that the prehistoric sites be recommended to the NRHP as a block to form a District, 2) that JM043, Old Las Animas, be recommended to the NRHP for its historic significance, and that 3) Old Caddoa be recorded and evaluated for NRHP significance should it ever appear from beneath the John Martin Reservoir waters.

The 111 prehistoric sites are recommended for eligibility considerations because they have integrity as a block and meet the criterion of 36CFR60.6(d) for yielding scientific information. Two of these sites, JM081 and JM124, have been tested and found to contain intact subsurface deposits which would make them eligible in their own right. However, it appears far more efficient to recommend them as part of the larger district rather than as separates. We propose to name this district the John Martin Prehistoric District.

Thirty-four sites with historic components were also evaluated for significance according to the criteria of 36CFR60.6. Of these, only Old Las Animas is deemed worthy of recommendation to the Keeper of the Register. The remaining sites are either lacking of integrity or not of regional or national significance; better examples of architectural style or site type are known from outside of the reservoir district. Also these historic components are not related to significant historic persons or people.

Old Las Animas, however, does meet the criteria for NRHP eligibility. Founded in 1869, it is one of the first serious attempts to establish a permanent Euro-American community in the region. A detailed history of the townsite is provided in Section 8.3 and full documentation for nomination to the Register is provided in

Section 11.0, according to the Appendix A outline of 36CFR63. However, as discussed in Section 11.0, serious plundering by bottle collectors is currently underway and immediate remedial action must be taken to prevent further destruction of this historically significant property.

There was one other important historic site which could not be recorded because it lies beneath the water of the reservoir. Should the site of the town of Old Caddoa ever appear above the waterline, the COE is urged to record it immediately and assess the site in terms of the criteria for nomination to the NRHP.

10.8 CONCLUSION

In conclusion, the cultural resources inventory of the John Martin Reservoir Project Area has shown that this region has been the location of human activity for at least 7,500 years, from the Early Archaic Period to the twentieth century. The evidence of prehistoric remains include lithic scatters, rock art sites, stone circles, and shelters. Most of the 111 prehistoric sites were lithic scatters. These kinds of sites hold potential for scientific studies on such subjects as stone tool technology, tool use, spatially differentiated task activities, site chronology, lithic procurement, hunting practices, vegetal collecting, and other land-use strategies. In addition, habitation sites, such as rock shelters and the remains of houses evidenced by dry laid stone wall foundations, can potentially provide data on architecture and a sedentary lifestyle. SAI's testing program showed that these rock shelters contained stratified cultural deposits which could provide information about subsistance and storage vessels. Other kinds of information could be obtained from the complete recording and stylistic analysis of the rock art found along Rule Creek.

The prehistoric investigations were able to apply a sophisticated research design to the site data. Objective conclusions about past behavior were formulated using the scientific methods of hypothesis testing. An innovative approach to lithic scatters resulted in a classification system based on frequencies of artifact types, as sorted through use of various computer programs. From these analyses, two basic site types were defined: base camps and special-activity sites. The base camps cluster on the south side of the Arkansas River, near Rule Creek. Here a wide variety of activities took place as water was near; large-seeded grasses could be harvested from the stabilized dunes and stone tools manufactured.

On the other hand, special-activity sites were found mostly on the north side of the project area, away from the Arkansas River, near intermittent drainages and in areas of high ecological diversity. Small in size, these sites tended to cluster in groups, and evidenced relatively simple artifact inventories. They probably functioned as lithic procurement and early-stage reduction areas, as well as hunting camps and collecting stations.

From all of this data, a single, complexly organized, prehistoric community can be reconstructed reflecting a seasonal dispersal pattern, with base camps occupied during the fall and winter, and the various special-activity site clusters utilized during the spring and summer.

The historic sites data were interpreted in a slightly different manner. These sites were represented mainly by house foundation remains of farmsteads, ranch-related features, trash scatters, and a town. The Arkansas River Valley is best known in the historic literature for its fur trade associations. Here the Bents centered their trading empire, and the tracks of the Old Santa Fe Trail run along the north bank of the Arkansas River, through the project. But the physical remains of the historic sites tell a different story. While almost no evidence of the fur trade period could

be found, the ranching and farming activities of the late nineteenth and early twentieth century were clearly represented by a significant number of sites in the project area.

The historic studies were unique in that they used both archival and archeological data to examine the historic sites located during the survey. This data was quantified to investigate such topics as land use, settlement patterns, and demography. It was found that the project area was settled relatively late, after 1880, primarily by native-born A^mericans of European descent. This was a relatively stable rural region with land, in the hands of local people, being held by one family for significant periods of time and being sold relatively infrequently. Most farmsteads started out small but the successful ones grew in size over time. But more importantly, this study proved the importance of applying quantitative techniques to the analysis of both archival and archeological data. This analysis allowed generalizations to be made about patterns of human behavior in the project area during historic times, and aided in the interpretation and evaluation of historic sites in the John Martin Reservoir region.

The focus for human activity in this region during both prehistoric and historic times was always the Arkansas River. It served as a line of communication and travel, and provided an environment condusive to human development and adaptation. Here early prehistoric peoples could adapt to a hunting and gathering subsistance pattern. In protohistoric times, the Plains Apache settled here in agricultural communities. During the historic period, Euro-Americans found the region naturally suited to raising cattle and, later, with the ntroduction of large-scale irrigation, the Arkansas River Valley emerged as a productive agricultural area.

Science Applications, Inc. believes this report represents a fruitful experience in cultural resources management. It provides both useful management data, as well as making an important contribution to the field of *scientific inquiry.*

SECTION 11.0
SITE MANAGEMENT DATA
by Frank W. Eddy and Paul D. Friedman

The following section documents the applied research portion of the John Martin Reservoir Project. As specified in the contract, the management goal of the survey is to bring the Corps of Engineers into full compliance with Executive Order 11593. This goal is to be carried out according to four managerial objectives to include: (1) location, identification, and description of both cultural and paleontological resources on fee and easement lands of the John Martin Reservoir Project; (2) evaluation of all cultural resources for the NRHP using the criteria of 36CFR60.6; (3) consideration of sources of adverse impact on these resources; and (4) recommendation of management strategies.

11.1 SUMMARY OF RECOMMENDATIONS

The following section will summarize the recommendations for both the prehistoric and historic sites located during the survey. These recommendations specifically address the significance of sites in terms of their possible eligibility to be nominated to the National Register of Historic Places. As pointed out in Section 10.0, the prehistoric sites are recommended for nomination to the NRHP as a district. This summary will illustrate the characteristics of each site which influence its importance, both in terms of the research questions posed by this investigation, and in terms of their research potential for the future. Only one historic site, JM043, is recommended for nomination to the NRHP. Therefore, the discussion of the historic sites will focus upon it, and explain its significance.

The major background for this section is presented in two tables. Table 11.1 will identify major research themes and list which prehistoric sites have the potential to address those topics. Table 11.2 will describe each site in terms of its location, size, features, function, cultural affiliation, adverse impacts, and recommendations.

11.1.1 PREHISTORIC SITE EVALUATIONS

One hundred and eleven sites with prehistoric components of occupation were located and recorded during the cultural resource inventory of the John Martin Reservoir Project. The majority of these sites are lithic scatters divisable into base camps and special-activity sites by means of the NTSYS analysis. These site types were usually marked by thin spreads of stone artifacts occuring in the open, on terraces found along both sides of the Arkansas River Valley. They lack a midden matrix but are sometimes accompanied by potsherds, fire hearths, scattered hearthstones, and/or dry laid masonry walls (Formative houses, unidentified stone rings, or tipi rings). A few rock shelters with evidence of prehistoric occupation were recorded as were rock art panels of pecked or incised drawings found on the cliff face of a sandstone outcrop (Section 5.0).

Dating of the prehistoric sites was difficult to achieve due to the general lack of stylistically distinctive artifacts such as projectile points and/or cord-marked pottery. However, the twelve sites which we could assign to temporal periods indicate a spread from early Archaic times until the proto-historic and early historic; an age span ranging from 7,000 years ago to the eighteenth and nineteenth centures (Section 5.4). Within this time spread, most of the sites are of late Archaic and Formative ages.

By means of our distributional studies, it was determined that artifact spreads within these lithic scatters showed a high degree of clustering, indicative of some work task specialization and more frequency of return visits to the same spot

TABLE 11.1
RESEARCH POTENTIAL BY PREHISTORIC SITE

	Research Domains			
Sites	Chronology Theme	Lifeway Theme	Evolutionary Theme	Priority
JM005	No data	3 artifact clusters; Site Cluster I.	Low	3
JM006	No data	Low artifact census; no artifact clusters; Site Cluster I.	None	4
JM007	No data	2 artifact clusters; Site Cluster I.	Low	3
JM008	No data	4 artifact clusters; Site Cluster I.	Low	3
JM009	No data	2 artifact clusters; Site Cluster I.	Low	3
JM010	No data	4 artifact clusters; Site Cluster I.	Low	3
JM011	No data	2 artifact clusters; Site Cluster I.	Low	3
JM012	No data	6 artifact clusters; Site Cluster I.	Low	3
JM013	No data	5 artifact clusters; Site Cluster I.	Low	3
JM014	No data	1 artifact cluster; low specimen census; Site Cluster I.	Low	3
JM015	No data	1 artifact cluster; low census; borrow pit disturbance; Site Cluster I.	Low	4
JM016	No data	6 artifact clusters; Site Cluster I.	Low	3
JM017	Hearth	5 artifact clusters; Site Cluster I	Medium	2
JM018	No data	1 artifact cluster; low artifact census; Site Cluster I.	Low	3
JM019	No data	7 artifact clusters; Site Cluster I.	Low	3
JM021	No data	2 artifact clusters; Site Cluster I.	Low	4
JM022	No data	I artifact cluster; cache of artifacts under rock; Site Cluster I.	Low	3
JM023	Hearth	3 artifact clusters; Site Cluster II.	High	2
JM024	Hearth	1 artifact cluster; Site Cluster II.	High	2
JM025	No data	2 artifact clusters; Site Cluster II.	Low	3
JM026	No data	5 artifact clusters; Site Cluster II.	Low	3
JM027	No data	2 artifact clusters; Site Cluster II.	Low	3
JM028	No data	2 artifact clusters; Site Cluster II.	Low	3
JM030	No data	3 stone tipi rings.	Moderate	2
JM031	Hearthstones; Sand Dune Stratigraphy	1 artifact cluster; special-activity site within Base Camp Cluster; low artifact census.	Moderate	2
JM032	Hearthstones; Sand Dune Stratigraphy; Unidentified Projectile Point	3 artifact clusters; special-activity site within Base Camp Cluster.	Moderate	2

Table 11.1 - continued

Sites	Research Domains: Chronology Theme	Research Domains: Lifeway Theme	Evolutionary Theme	Priority
JM033	Hearthstones	1 artifact cluster; special-activity site within Base Camp Cluster; low artifact census.	Moderate	2
JM034	Hearth	8 artifact clusters; special-activity site within Base Camp Cluster.	Moderate	2
JM035	Hearth; Period 5b Projectile Point; Pottery	4 artifact clusters; special-activity site within Base Camp Cluster.	High	2
JM036	Period 5a Projectile Point; Pottery	3 artifact clusters; special-activity site within Base Camp Cluster.	High	2
JM038	6 Hearths	7 artifact clusters; special-activity site within Base Camp Cluster.	High	2
JM039	No data	1 artifact cluster; 1 stone ring; outside Base Camp Cluster.	Moderate	3
JM043	Period 5b Projectile Point; Period 4 Projectile Point	3 artifact clusters; no site clustering.	High	2
JM051	Unidentified Projectile Point	6 artifact clusters; base camp in Site Cluster II.	High	2
JM052	Depth	Artifact clusters not defined; base camp in Site Cluster II.	Moderate	2
JM053	No data	2 artifact clusters; Site Cluster II.	Low	3
JM054	No data	No artifact clusters; low artifact cenus; Site Cluster II.	Low	3
JM055	No data	4 artifact clusters; Site Cluster II.	Low	3
JM057	No data	3 artifact clusters; Site Cluster II.	Low	3
JM058	No data	2 artifact clusters; Site Cluster II.	Low	3
JM059	No data	5 artifact clusters; Site Cluster II.	Low	3
JM060	Period 2 Projectile Point; Hearth; Hearthstones	3 artifact clusters; Site Cluster II.	High	2
JM061	Period 5b Projectile Point	2 artifact clusters; Site Cluster II.	High	2
JM062	Hearth	8 artifact clusters; Site Cluster II'	Moderate	2
JM063	Hearthstones	4 artifact clusters; Site Cluster II.	Moderate	2
JM064	No data	3 artifact clusters; Site Cluster II.	Low	3
JM066	No data	3 artifact clusters; Site Cluster II.	Low	3
JM067	Hearthstones	1 artifact cluster; not in a site cluster.	Low	2
JM068	Hearthstones	6 artifact clusters; not in a site cluster.	Low	2
JM069	No data	3 artifact clusters; not in a site cluster.	Low	3
JM070	No data	3 artifact clusters; Site Cluster IV.	Low	3

Table 11.1 - continued

Sites	Research Domains: Chronology Theme	Lifeway Theme	Evolutionary Theme	Priority
JM072	No data	3 artifact clusters; Site Cluster IV.	Low	3
JM073	No data	9 artifact clusters; Site Cluster IV.	Low	3
JM074	No data	4 artifact clusters; Site Cluster IV.	Low	3
JM075	No data	5 artifact clusters; Site Cluster IV.	Low	3
JM076	No data	6 artifact clusters; Site Cluster IV.	Low	3
JM077	Rockshelter with disturbed fill and fire-blackened roof	No artifacts; Site Cluster IV.	Moderate	2
JM079	No data	3 artifact clusters; Site Cluster IV; road disturbance.	Low	3
JM080	Rockshelter with fill and fire-blackened roof	No artifacts; Site Cluster IV.	Moderate	2
JM081	Rockshelter with depth of fill proven by testing; pottery; hearth; charcoal	Formative house on shelter surface; Site Cluster IV.	High	1
JM082	2 hearths	5 artifact clusters; Site Cluster IV.	Moderate	2
JM084	Bison (?) bones eroding from floodplain alluvium	4 artifact clusters; Site Cluster IV.	High	2
JM085	No data	4 artifact clusters; Site Cluster Iv.	Low	3
JM086	No data	6 artifact clusters; outside site clusters.	Low	3
JM087	Hearth	5 artifact clusters; Site Cluster III.	Moderate	2
JM088	6 Hearths	7 artifact clusters; Site Cluster III.	High	2
JM089	No data	1 artifact cluster; Site Cluster III.	Low	3
JM090	No data	5 artifact clusters; Site Cluster III.	Low	3
JM091	No data	7 artifact clusters; Site Cluster III.	Low	3
JM092	No data	5 artifact clusters; Site Cluster III.	Lc	3
JM093	No data	3 artifact clusters; Site Cluster III.	Low	3
JM094	No data	2 artifact clusters; Site Cluster III.	Low	3
JM095	No data	4 artifact clusters; Site Cluster III.	Low	3
JM096	3 Hearths	1 stone ring; 1 artifact cluster; Site Cluster III.	High	2
JM097	No data	3 artifact clusters; Site Cluster III.	Low	3
JM098	No data	7 artifact clusters; Site Cluster III.	Low	3
JM099	Hearth	5 artifact clusters; Site Cluster III.	Moderate	2
JM100	Hearth	7 artifact clusters; Site Cluster III.	High	2

Table 11.1 - continued

Sites	Research Domains: Chronology Theme	Lifeway Theme	Evolutionary Theme	Priority
JM102	Sand Dune Stratigraphy	1 artifact cluster; distribution disturbed by wave action; outside site clusters.	Moderate	2
JM103	Hearth; Sand Dune Stratigraphy	1 artifact cluster; special activity site within Base Camp Cluster.	High	2
JM104	Hearths; Unidentified Projectile Point Fragments	7 artifact clusters; 1 rock art panel; Base Camp Cluster.	High	2
JM106	Hearthstones; Sand Dune Stratigraphy	1 artifact cluster; Base Camp Cluster.	High	2
JM107	Sand Dune Stratigraphy in Two Blowouts; Hearth	1 artifact cluster; Base Camp Cluster.	High	2
JM108	Hearth; Hearthstones; Sand Dune Stratigraphy in a Blowout	4 artifact clusters; Base Camp Cluster.	High	2
JM109	Period 1 Projectile Point; Sand Dune Stratigraphy in Series of Blowouts; Hearthstones	4 artifact clusters; Base Camp Cluster.	High	2
JM110	Hearthstones; Sand Dune Stratigraphy	3 artifact clusters; Base Camp Cluster.	High	2
JM112	Hearth; Sand Dune Stratigraphy	1 artifact cluster; Base Camp Cluster.	High	2
JM113	Hearthstones; Sand Dune Stratigraphy	4 artifact clusters; metate clusters; Base Camp Cluster.	High	2
JM114	Sand Dune Stratigraphy	5 artifact clusters; Base Camp Cluster.	High	2
JM115	Sand Dune Stratigraphy	3 artifact clusters; special-activity site in Base Camp Cluster.	High	2
JM116	No data	4 artifact clusters; special-activity site in Base Camp Cluster.	Low	3
JM117	Period 5b Projectile Point	1 stone ring; 5 rock art panels; 6 artifact clusters; special-activity site in Base Camp Cluster.	High	2
JM118	No data	3 artifact clusters; Base Camp cluster; disturbed by modern quarry activity.	Low	3
JM119	Rule Creek Floodplain Alluvium	2 artifact clusters; Base Camp Cluster.	High	2
JM120	Rule Creek Floodplain Alluvium	2 artifact clusters; Base Camp Cluster.	High	2
JM122	No data	1 artifact cluster; special-activity site in Base Camp Cluster.	Low	3
JM123	Period 1 Projectile Point; Hearth; Stone Sighting Alignment	1 artifact cluster; Base Camp Cluster.	High	2
JM124	Formative House with Depth of Fill Proven by Testing; Rule Creek Alluvium	1 artifact cluster; Base Camp Cluster.	High	1
JM125	Hearth; hearthstones; Rule Creek Alluvium	1 artifact cluster; Base Camp Cluster.	High	2
JM126	3 Hearths; Hearthstones; Period 5b Projectile Point	Stone circle; tipi ring; 4 artifact clusters; Base Camp Cluster.	High	2

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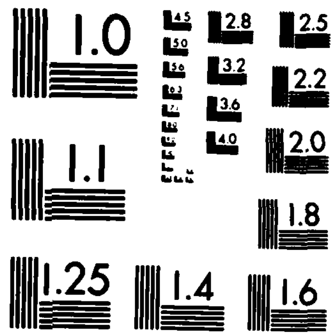
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Table 11.1 - continued

Sites	Research Domains: Chronology Theme	Research Domains: Lifeway Theme	Evolutionary Theme	Priority
JM128	No data	Rock art panel; 1 artifact cluster; stone ring houses (?); Base Camp Cluster	Low	3
JM129	No data	2 artifact clusters; Base Camp Cluster.	Low	3
JM130	Rule Creek Floodplain Alluvium; 8 Hearths; Hearthstones	4 artifact clusters; Base Camp Cluster.	High	2
JM131	Rule Creek Floodplain Alluvium; Hearthstones	2 artifact clusters; Base Camp Cluster.	High	2
JM132	Period 5b Projectile Point; Pottery; Rule Creek Floodplain Alluvium, 12 Hearths; Hearthstones	7 artifact clusters; Base Camp Cluster.	High	2
JM133	24 Hearths; testing demonstrated no depth to artifacts	5 artifact clusters; Base Camp Cluster.	High	2
JM134	Period 3 and Period 5a Projectile Points; Rules Creek Floodplain Alluvium and Sand Dunes; 3 Hearths; Hearthstones	8 artifact clusters; Base Camp Cluster.	High	2
JM151	Hearth; Hearthstones; Rock Cairn; Stone Circle	6 artifact clusters; Site Cluster II.	Moderate	2
JM153	No data	No artifact clusters; Site Cluster II.	Low	3
JM154	No data	2 artifact clusters; Site Cluster II.	Low	3
JM155	No data	2 artifact clusters; Site Cluster III.	Low	3

Table 11.2
Management Data by Site

Property Name	Adverse Impacts	Recommendations
JM001 (5BN136) Siglea Homestead	Inundation, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM002 (5BN137)	Inundation, Recreation	Completed: recorded Recommendations: NFW Priority: 4
JM003 (5BN138)	Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM004 (5BN139)	Inundation, Recreation	Completed: recorded Recommendation: NFW Priority: 4
JM005 (5BN140)	Vandalism, Recreation	Completed: recorded, mapped Recommendations: avoid, collect, test Priority: 3
JM006 (5BN141)	Recreation	Completed: collected, recorded, mapped Recommendations: NFW Priority: 4
JM007 (5BN2)	Inundation, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM008 (5BN142)	Vandalism, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM009 (5BN143)	Vandalism, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM010 (5BN144)	Erosion, Vandalism, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM011 (5BN145)	Erosion, Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM012 (5BN146)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid, collect Priority: 3
JM013 (5BN147)	Animal Activity, Vandalism, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM014 (5BN148)	Erosion, Vandalism	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM015 (5BN149)	Construction, Recreation	Completed: recorded, mapped Recommendations: avoid, NFW Priority: 4
JM016 (5BN150)	Erosion, Animal Activity, Vandalism	Completed: recorded, mapped Recommendations: avoid, NFW Priority: 3
JM017 (5BN151)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM018 (5BN152)	Recreation	Completed: recorded, mapped, collected Recommendations, avoid Priority: 3
JM019 (5BN153)	Erosion, Animal Activity, Vandalism, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM020 (5BN154)	Erosion, Animal Activity, Vandalism, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM021 (5BN155)	Erosion, Animal Activity, Vandalism, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM022 (5BN156)	Inundation, Vandalism, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM023 (5BN157)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM024 (5BN158)	Erosion, Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM025 (5BN159)	Erosion, Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM026 (5BN160)	Erosion, Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM027 (5BN161)	Inundation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM028 (5BN162)	Erosion, Animal Activity	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM029 (5BN163) Baldwin Homestead	None	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM030 (5BN164)	Inundation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM031 (5BN165)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM032 (5BN166)	Erosian, Animal Activity	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM033 (5BN167)	Erosion, Animal Activity	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM034 (5BN168)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM035 (5BN169)	Inundation, Erosion,	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM036 (5BN170)	Inundation, Erosion	Completed: recorded, collected, mapped Recommendations: NFW Priority: 2
JM037 (5BN171) Huey Ranch	Inundation, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM038 (5BN101)	Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM039 (5BN172)	Erosion	Completed: recorded, mapped Recommendation: avoid Priority: 3
JM040 (5BN173)	Erosion, Vandalism	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM041 (5BN174) Dobbins House	Vandalism 3875 ft.	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM042 (5BN175) Beach House	Vandalism	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM043 (5BN176) Old Las Animas	Vandalism	Completed: recorded, collected, mapped Recommendations: excavation, extensive testing Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM044 (5BN177)	Inundation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM051 (5BN178)	Erosion, Animal Activity	Completed: recorded, collected, mapped Recommendations: map, test Priority: 2
JM052 (5BN179)	Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM053 (5BN180)	None	Completed: recorded, mapped Recommendations: collect Priority: 3
JM054 (5BN181)	None	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM055 (5BN182)	Erosion, Animal Activity, Vandalism	Completed: recorded, mapped Recommendations: test Priority: 3
JM056 (5BN183) Irvine Homestead	Vandalism	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM057 (5BN184)	Inundation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM058 (5BN185)	None	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM059 (5BN121)	Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM060(5BN186)	Inundation, Animal Activity, Construction	Completed: recorded, mapped Recommendations: avoid, test hearth if necessary Priority: 2
JM061 (5BN187)	Inundation, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 2
JM062 (5BN188)	Inundation, Recreation	Completed: recorded, mapped Recommendations: avoid, test hearth, screen material Priority: 2
JM063 (5BN189)	Inundation, Construction, Recreation	Completed: recorded, mapped Recommendations: avoid, collect, and test Priority: 2
JM064 (5BN190)	Erosion	Completed: recorded, mapped Recommendations: avoid, collect Priority: 3
JM065 (5BN191) Frank Baldwin Ranch	Inundation, Construction	Completed: mapped, recorded Recommendations: NFW Priority: 4
JM066 (5BN192)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM067 (5BN193)	Erosion, Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 2
JM068 (5BN194)	Inundation, Erosion, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 2
JM069 (5BN195) Pierce Homestead	Animal Activity, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM070 (5BN196)	Erosion, Animal Activity, Construction	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM071 (5BN197) Gass Homestead	Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM072 (5BN198)	Animal Activity, Construction, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM073 (5BN199)	Animal Activity, Construction, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM074 (5BN200)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM075 (5BN201)	Construction, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM076 (5BN202)	Erosion, Animal Activity, Construction, Recreation	Completed: recorded, Recommendations: avoid Priority: 3
JM077 (5BN118)	Animal Activity, Recreation	Completed: recorded, mapped Recommendations: test Priority: 2
JM078 (5BN203) Fannie Clay Homestead	Animal Activity, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM079 (5BN204)	Erosion, Construction, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM080 (5BN205)	Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM081 (5BN206)	Recreation	Completed: recorded, mapped, tested Recommendation: excavation Priority: 1
JM082 (5BN207)	Erosion, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM083 (5BN208) Ford House	Recreation	Completed: recorded Recommendations: NFW Priority: 4
JM084 (5BN209)	Animal Activity, Construction, Recreation	Completed: recorded, mapped Recommandations, avoid, test Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM085 (5BN210)	Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM086 (5BN211)	Construction, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM087 (5BN212)	Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM088 (5BN213)	Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM089 (5BN214)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM090 (5BN215)	Erosion, Construction, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM091 (5BN216)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM092 (5BN217)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM093 (5BN218)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM094 (5BN219)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM095 (5BN220)	Erosion, Animal Activity, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM096 (5BN221)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid, test Priority: 2
JM097 (5BN222)	Erosion, Animal Activity/Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 3
JM098 (5BN223)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid, test Priority: 3
JM099 (5BN223)	Construction, Recreation	Completed: recorded, collected, mapped Recommendations: avoid, test Priority: 2
JM100 (5BN224)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM101 (5BN225) Myers Homestead	Erosion	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM102 (5BN226)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM103 (5BN227)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM104 (5BN14)	Inundation, Erosion, Vandalism	Completed: recorded, mapped Recommendations: avoid, test Priority: 2
JM105 (5BN228) Graham Homestead	Construction	Completed: mapped Recommendations: cistern needs to be filled, but fill should not come from site area Priority: 4
JM106 (5BN229)	Erosion	Completed: recorded, mapped Recommendations: avoid, test Priority: 2
JM107 (5BN230)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid, test Priority: 2
JM108 (5BN231)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid, test Priority: 2
JM109 (5BN232)	Inundation, Erosion	Completed: recorded, collected Recommendations: avoid Priority: 2
JM110 (5BN233)	Inundation, Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM111 (5BN234)	None	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM112 (5BN235)	Inundation, Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM113 (5BN236)	Inundation	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM114 (5BN237)	Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM115 (5BN238)	Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM116 (5BN239)	Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM117 (5BN122)	Erosion, Vandalism	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM118 (5BN240)	Construction	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM119 (5BN241) Gerstenkorn Ranch	Inundation, Construction	Completed: recorded, mapped Recommendations: avoid Priority: 2

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM120 (5BN242) Carrie Allen Homestead	Erosion, Recreation	Completed: recorded, mapped Recommendations: avoid, test Priority: 2
JM121 (5BN243) Carrie Allen Homestead	Erosion, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4.
JM122 (5BN244)	Erosion	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM123 (5BN245) 3000 B.C.	Erosion	Completed: recorded, mapped Recommendations: collect, test Priority: 2
JM124 (5BN246)	Erosion, Recreation	Completed: recorded, mapped, tested Recommendations: excavate Priority: 1
JM125 (5BN247)	Inundation, Erosion, Animal Activity	Completed: recorded, mapped Recommendations: collect, test Priority: 2
JM126 (5BN248)	Erosion	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM127 (5BN249)	Inundation, Erosion	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM128 (5BN007) Hicklin Springs	Vandalism	Completed: recorded Recommendations: further detailed recording Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM129 (5BN250)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM130 (5BN008)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid, collect Priority: 2
JM131 (5BN251)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM132 (5BN252)	Erosion, Animal Activity	Completed: mapped, recorded, tested Recommendations: collect Priority: 2
JM133 (5BN254)	Erosion, Animal Activity	Completed: recorded, mapped Recommendations: avoid Priority: 2
JM134 (5BN254)	Inundation, Recreation	Completed: recorded, mapped Recommendations: avoid, collect Priority: 2
JM151 (5BN255)	Erosion, Recreation	Completed: recorded, collected, mapped Recommendations: avoid Priority: 2
JM152 (5BN256) Lund Homestead	Inundation, Recreation	Completed: recorded, mapped Recommendations: NFW Priority: 4
JM153 (5BN257) Dwyer Homestead	Construction, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3

Table 11.2 - continued

Property Name	Adverse Impacts	Recommendations
JM154 (5BN258)	Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3
JM155 (5BN259)	Erosion, Recreation	Completed: recorded, mapped Recommendations: avoid Priority: 3

on a seasonal schedule. Distributional studies between sites further revealed that the special-activity sites are clustered into four numbered sets on the north bank of the river while the base camps cluster into one set on the south bank. A transhumant pattern of seasonal movement is posited to account for these distributions.

In order to evaluate these sites in terms of their eligibility for nomination to the NRHP, the pertinent data for each site is plotted against the major research themes which have been examined in this volume. These themes are those of chronology, functional lifeway reconstruction, and evolutionary studies (Section 4.3). In this manner, a system of priority ranking was achieved according to the contribution that each site could potentially make to these three research questions; a measure of site significance.

Sites with dating potential include those with hearths, hearthstones, datable artifacts, and some possibility of depth based on a stratigraphic relationship with Holocene floodplain alluvium and/or Holocene eolin deposits. The hearths and scattered hearthstones provide the potential for dating by radiocarbon, thermoluminescence, and/or archaeomagnetic means. Dating by artifact style has already been mentioned, but see Sections 5.3 and 5.4 for specifics.

Lifeway potential is determined based on the integrity of artifact distributional patterning both within and between sites. The supposition employed here is that N- or C-transforms which have seriously randomized artifact or site distributional patterns have, in fact, largely destroyed their functional data. On the other hand, those sites with intrasite and intersite clusterings are, in fact, potentially useful in reconstructing past functional lifeways.

Sites which can potentially contribute to evolutinary studies are those with excellent chronological controls, as well as distributional integrity. For this reason, only those sites with both dating and lifeway potentials were, in fact, evaluated as having a high potential to contribute to the evolutionary theme. By the same token, those sites with a medium evolutionary rating lack much evidence of dating potential, while those rated low in their contribution to the evolutionary research theme have no chronological data in evidence.

Employing these criteria, sites were rank ordered in terms of their priority of research potential, a means of objectively determining their significance as shown on the right hand column of Table 11.1. The ordinal scale covers four ranks, numbered from high priority (most significant) to lowest (least significant). Further, Rank 4 sites are deemed ineligible to the NRHP. The ranks and their criteria are as follows:

Rank 1 = Highest ranking based on proven site depth and integrity determined by test excavations. Pertains only to JM081 and JM124 (Section 5.6).

Rank 2 = Medium ranking based on sites with both dating potential and intrasite artifact clustering indicating a high site integrity with potential for lifeway study. Also unusual site features may be present. These sites are usually part of a site cluster and thus have potential for contributing to an understanding of the larger prehistoric community.

Rank 3 = Low ranking based on sites lacking dating potential although some intraside distributional integrity is present. The contribution that these sites can make to evolutionary studies is virtually nil.

Rank 4 = Lowest ranking sites are those field recommended for no further work (NFW). They have been seriously disturbed by either N- or C-transforms either in the past or within the historic present. These sites are not recommended for NRHP consideration.

Inspection of Table 11.1 shows the following frequency distribution of NRHP significance (priority): Rank 1 (2%), Rank 2 (48%), Rank 3 (49%), and Rank 4 (2%) calculated on a base tally of 111 prehistoric sites. Thus only two sites have proven stratigraphic potential and artifact assemblage integrity; that is JM081 and 124. Forty-eight percent of the prehistoric sites have research potential for chronological, lifeway, and evolutionary studies, while another 49% have potential for temporal control which is so important in diachronic study of evolutionary processes. These Rank 3 sites are uniformly rated as low potential on the evolutionary theme. And finally, two sites (JM006 and JM015) are considered Ranked 4, meaning that they are not eligible for recommendation to the NRHP. Both of these sites lack chronological data and their artifact assemblage integrity has been seriously affected by construction disturbance or lack of intrasite artifact patterning.

From this management review, it is recommended that 109 prehistoric sites be considered for district nomination to the NRHP. The section to follow provides the detailed support for this recommendation according to the criteria spelled out in 36CFR63, Appendix A.

11.1.2 HISTORIC SITES EVALUATIONS

Thirty-four sites with historic components were located and recorded during the cultural resources inventory of the John Martin Reservoir Project. Eighteen sites were farmsteads, five were ranch-related features, ten were trash scatters, and one was a townsite.

The trash scatters are sites of almost no archeological or historical significance. Some contain artifacts that date back to the turn of the century, but most are more recent, probably representing the period 1920-1940 or later. These sites have no features or remains of habitation. They are merely concentrations of refuse. Some of the trash scatters were created by nonhuman forces, such as wave action along the shore of the reservoir, while others are purposeful dump areas. These sites tell very little about the history of settlement and land-use patterns for the region. They do indicate something about the range of material goods used by residents of the area, but other sites provide this same kind of information within the context of a place of human occupation.

The ranch-related sites are usually isolated features which have some connection to ranching activities but exhibit no evidence of domestic habitation. They indicate something about land use, but offer little insight into settlement patterns and residential locations. These sites are not considered significant in terms of the criteria for nomination to the NRHP.

The farmsteads present the most difficult group of sites to evaluate. These sites were farms or ranches with visible remains related to domestic habitation. For the most part, they consist of the remains of a sandstone or concrete house foundation, and associated features such as a cellar, cistern or well, outbuildings, privy, and artifact scatter. These sites date from 1880 to 1940. Most are in a deteriorated state, and some show evidence of having been bulldozed by the COE at the time of the dam construction. Few of the farmsteads seem to have any potential for subsurface remains, and most do not warrant future investigations.

The two standing structures (JM041 and JM042) will be considered separate from the rest of the farmsteads because they are in the best state of repair, and must be evaluated in terms of their architectural merit. JM041 is the so-called "Dobbin's House." The fact that it was constructed of adobe indicated that it was somewhat unusual for the project area, and represented a distinct style of construction. Unfortunately, historical research failed to define its exact dates of construction, or its builder. It has been speculated that the house was built by the Dobbin family in the 1890s, but there is no way to substantiate this from the records available. The house was occupied in association with the operation of a small farm. The history of the site is discussed in Section 8.3. The house was not associated with a particular historic event or associated with a famous person. It does exhibit a distinctive style of construction. However, better examples of adobe houses, dating from an earlier period, still exist throughout southern Colorado. In terms of the criteria spelled out in 36CFR60.6, it is believed that this site should not be considered eligible to be nominated to the National Register.

JM042 is a much more modern house, constructed of concrete blocks. This site, called the "Beach House," may date to 1913, but it was almost impossible to determine exactly when it was built, or by whom, from the historical documents (see Section 8.3). Like JM041, this house was also associated with a small farm. It is typical of many of the modern farm houses built in this region, and is in no way distinctive or unusual. It does not meet the criteria for nomination to the NRHP.

Taken as a group, it is the opinion of the investigator that these farmsteads do not represent a significant data pool, and are not eligible to be nominated to the NRHP. As a whole, the historic farmsteads recorded during the John Martin Reservoir Project did present an important block of information about regional settlement patterns and land use. However, most of this information was extracted from the historic records, and not from the physical remains of the sites themselves. It should be pointed out that much better examples of farmsteads representing the same time period are extant throughout the region surrounding the project area.

The only historic site which was determined to be eligible for nomination to the NRHP is the original townsite location of Old Las Animas (JM043/5BN176). The following documentation according to the stipulations of 36CFR63, Appendix A, should support this evaluation.

11.2 DOCUMENTATION FOR NRHP NOMINATION

Two recommendations are made to the COE for nomination to the NRHP. These are that the block of 109 prehistoric sites be nominated to the Keeper of the Register as eligible for inclusion on the National Register. The second recommendation is that the old townsite of Las Animas be nominated. The following documentation is presented to support these contentions.

11.2.1 JOHN MARTIN PREHISTORIC DISTRICT

The prehistoric sites are recommended as a district since they have integrity as a block with strong potential to contribute to the scientific knowledge of southeastern Colorado. No single individual site alone seems worthy of submission for determination of eligibility since it would have little meaning in isolation from its fellows.

11.2.1.1 LOCATION

The district is located on fee and easement lands which are part of the John Martin Reservoir Project of Bent County, southeastern Colorado. The property lines guiding survey are marked on

Figure 2.2 where they are shown in relation to the legal descriptions of Township, Range, and Section. The location of individual sites is listed on Table 11.2. In addition, UTM locations are given on each individual Colorado Cultural Resource Inventory Record (Part II): copies of which are on file with both the Colorado Preservation Office (Denver, Colorado) and the Albuquerque District office of the COE.

11.2.1.2 CLASSIFICATION

It is felt that the block of prehistoric sites recorded within the John Martin Reservoir Project should be evaluated as a district since they occupy a geographically definable area possessing a significant continuity of prehistoric occupation.

11.2.1.3 OWNERSHIP

The COE holdings consist of 20,648 acres of fee ownership. An additional 4,976 acres of easement lands were also surveyed.

11.2.1.4 REQUEST FOR DETERMINATION OF ELIGIBILITY

The lead Federal agency in the John Martin Reservoir Project is the Corps of Engineers who will be requesting a determination of eligibility from the Keeper of the Registry. The COE office to be contacted in this matter is the Albuquerque District, 517 Gold S.W., Albuquerque, NM 87103.

11.2.1.5 REPRESENTATION IN EXISTING SURVEYS

The literature search conducted during the planning phase of this project indicated that there has been several previous archeological surveys of the region around John Martin Reservoir. Charles Steen surveyed part of this region in 1933-1934 for the Colorado Archeological Survey (COE 1976:11-17). Also in the early 1930s, E. B. Renaud of the University of Denver made several surface reconnaissances into eastern Colorado (Gunnerson 1960). Steen designated his sites with letter, calling one site A, another site H, and so on. Renaud's notes indicated that he relocated several of Steen's sites and applied his own numbering system to them. For example, Steen's site No. A was called Site No. 235 by Renaud. In 1954 Joe Ben Wheat of the University of Colorado Museum conducted a brief survey around the reservoir. He used the Smithsonian numerical system to label the sites he found. Wheat re-recorded several sites previously located by Steen and Renaud. In 1969, Robert Campbell wrote his Ph.D. dissertation about investigations on the Chaquaqua Plateau. In his dissertation he listed Bent County site numbers 5-71 (using the Smithsonian system). Because the site files, then under the care of the University of Colorado Museum, already had sites 5BN5 through 5BN18 listed, there was some confusion as to Campbell's duplications of previously numbered sites.

The most recent survey of the area was a program to record prehistoric rock art in the area, conducted in 1971 by J. Randall for the Colorado Archaeological Society.

The site file search of the records of the Colorado Preservation Office revealed that there were 24 previously recorded archeological sites within the general region surrounding the project area. Within the confines of the reservoir boundaries itself, 20 previously recorded sites were found. During the SAI cultural resources inventory of the John Martin Reservoir, nine of these sites were relocated. Some sites, it was discovered, were recorded more than once in the past (see Figure 2.3).

The field investigations of SAI were conducted during the summer of 1980 when 134 archeological sites and 103 isolated finds were recorded. The sites contained 111 prehistoric

and 34 historic components. Although fee and easement lands for the John Martin Reservoir cover 10,374. ha, in fact the existing lake, marshlands, and silt-covered basin bottom reduced the effective survey coverage to 6276.9 ha to produce a density of 0.01768 prehistoric sites per ha. Because of these impediments to survey coverage, the site inventory is generally biased in the lack of sites located along the river behind the dam, in the wetland areas at the upper end of the reservoir, and from the floodplain of Rule Creek.

11.2.1.6 DESCRIPTION

The block of 109 prehistoric sites largely consist of lithic scatters which hold potential for scientific studies on the subjects of stone tool technology, tool use, spatially differentiated task-activities, site chronology, lithic procurement, hunting practices, vegetal collecting, and other land-use strategies. In addition, some of these sites have dry-laid stone walls or are found in rockshelter overhangs where they potentially can provide data on architecture and a sedentary life-style. Further, some shelters contain stratified dry deposits with perishable artifacts and food remains; relationships which have been demonstrated in part through our test excavations (see Section 5.6). Other kinds of scientific potential include the stylistic analysis and complete recording of the rock art panels which tend to cluster on the cliff faces bordering the lower reach of Rule Creek.

11.2.1.7 SIGNIFICANCE

The John Martin Prehistoric District is recommended for determination of eligibility to the Keeper of the Registry based on the criterion of a block of sites "that have yielded, or may be likely to yield, information important in prehistory..." (36CFR60.6(d)). Chronological evidence indicates the potential for diachronic studies extending from early Archaic times through historic, Euro-American contact. Although these age assessments are based on a limited number of stylistically sensitive artifacts (projectile points and cord-marked ceramics) of dateable age, still the research potential for a long cultural sequence is suggested. Further assistance in the chronological matter could likely be provided by thermoluminescence dating of the fire-cracked rock on surface sites as well as radiocarbon dating of any hearth found in buried dune sites, alluvial sites, or rockshelter deposits such as the subsurface hearth of the JM081 test pit (Section 5.6).

The John Martin sites further offer the potential of synchronic lifeway studies through horizontal excavations of sites buried in floodplain alluvium as well as those incorporated within the old dune field. Such intensive, lateral excavations offer the research potential of defining task-activity locales within sites. These can be spotted by artifact clusters with distinctive subassemblages reflecting spatial differences in past behavior; a research potential which has already been demonstrated for the surface lithic scatter sites (Section 6.0).

In addition to studies of time and formal content, excavations in buried sites or sites with depth could yield important information in the study of past adaptation to the natural environment. Particularly, the large number of Archaic age sites strongly suggests a close fit with Altithermal and Neoglacial periods through intensive gathering. The high frequency of milling tools found in the dune fields is suggestive of grass seed processing by Archaic peoples during Neoglacial times. The buried dune sites may provide evidence of Plains occupation during the Altithermal; a relationship which is contrary to Benedict's (1979) hypothesis of Plains abandonment between 5000 and 8000 years ago.

A research theme related to that of adaptations is the study of evolutionary developments. The potential here lies in the 53 prehistoric sites

which contain both dateable archeological materials and structured artifactural distributions (Table 11.1). Through mitigation studies, these materials could be examined for both diachronic change and persistence according to the evolutionary hypotheses devised in Section 4.3.2.3.

11.2.1.8 BIBLIOGRAPHY

Pertinent references for the John Martin Prehistoric District are summarized in the Regional Overview (Section 4.1) and presented as a formal listing in the Bibliography (Section 14.0).

11.2.1.9 GEOGRAPHICAL DATA AND MAPS

Detailed site locations have been plotted on 7.5 minute series, USGS topographic maps and orthophoto quads for submission to the Albuquerque COE as separate deliverables. These maps provide latitude and longitude coordinates for the proposed National Registry District. Locational data on the individual sites has also been submitted as part of the Colorado Inventory Site Forms.

11.2.1.10 PHOTOGRAPHS

Individual site photos have been submitted as separate deliverables to the COE in the form of a record book of black-on-white glossy prints and two original color transparencies.

11.2.1.11 INDIVIDUALS COMPILING DOCUMENTATION

Information for this prehistoric district recommendation was compiled by Frank W. Eddy, PI for the John Martin Reservoir Project. The research was conducted under contract from the COE to the Science Applications, Inc. Addresses are provided in full on the report title page.

11.2.2 JOHN MARTIN HISTORIC SITE NOMINATION

Only one historic site is considered eligible to be nominated to the NRHP. This site, JM043, the former townsite of Old Las Animas, is significant because it represents the first attempt of town building in the region, and holds great potential for future research on early townsites in Colorado and their range of material culture. The following documentation will support this contention.

11.2.2.1 LOCATION

The site of Old Las Animas is located on the south side of the Arkansas River, east of the Purgitoire River, across from Fort Lyon. Its exact legal description can be found on the Colorado Cultural Resources Inventory Record on file at the Colorado Preservation Office.

11.2.2.2 CLASSIFICATION

The location of Old Las Animas was recorded as a historic archeological site. It contains both historic and prehistoric cultural components. However, its nomination to the National Register should be based upon its historic significance as a townsite.

11.2.2.3 OWNERSHIP

The site is located on property owned by the United States Government and managed by the Army Corps of Engineers (COE), Albuquerque District.

11.2.2.4 REQUEST FOR DETERMINATION OF ELIGIBILITY

The Federal agency which must take the lead in requesting the determination of eligibility for this site is the COE.

11.2.2.5 REPRESENTATION IN EXISTING SURVEYS

The site of Old Las Animas does not appear in any previous archeological or historic surveys, although the location is well known to local collectors.

According to the files at the Colorado Preservation Office only seven historic sites have been identified by previous research as being located in or near the project area. They are the Fort Lyon VA Hospital Grounds and Cemetery (Site No. 06/01/0001), the Barlow and Sanderson Stage Line Route (Site No. 06/01/0007), the route of Fremont's Third Expedition (Site No. 06/01/0010), the Santa Fe Trail (Site No. 06/01/0011), the route of the Long Expedition (Site No. 06/01/0004), the route of the Pike Expedition (Site No. 06/01/0005), and the route of the Gunnison Expedition (Site No. 06/01/0006). None of these sites were relocated during the survey. However, all of them have been discussed in the Historical Overview (Section 7.1).

11.2.2.6 DESCRIPTION

Site JM043 represents the original location of the town of Old Las Animas. The physical remains consist of stone foundations, walls, depressions, and a wide artifact scatter. The site covers over 500 sq. m. A detailed description can be found in Section 8.3.

11.2.2.7 SIGNIFICANCE

Site JM043 it thought to be eligible for nomination to the NRHP under both Criteria a and d of 36CFR60.6. The events surrounding the founding, occupation, and abandonment of Old Las Animas are an important part of the history of this region. There is great potential for significant subsurface remains at this site, and no doubt it can yield important historic and archeological information.

Old Las Animas, also known as Las Animas City or East Las Animas, was established in 1869 as a service center for New Fort Lyon and the surrounding rural countryside. Its hopes for future growth was based upon the assumption that both the Kansas Pacific and Atchison, Topeka, and Santa Fe Railroads would extend their lines to the town. Instead, a group of outside speculators founded a rival town, West Las Animas, just five miles away from the old townsite. It was West Las Animas that received the railhead and later became the seat for Bent County. The repercussions of this land swindle reached all the way to Washington, D.C. but, once the deed was accomplished, it was the beginning of the end for Old Las Animas. People abandoned the place in favor of the new townsite. By the end of the 1880s, most of the buildings were removed or left to rot, and Old Las Animas was no more--the newer town taking even its name. A detailed history of the site can be found in Section 8.3. The story behind it is important for Old Las Animas was one of the first attempts to establish a permanent Euro-American community in the region.

11.2.2.8 BIBLIOGRAPHY

The references used to research the history of this site can be found within the text of the site description for JM043 (see Section 8.3). These sources are repeated in the Bibliography of this report (Section 14.0).

11.2.2.9 GEOGRAPHIC DATA AND MAPS

The Colorado Cultural Resources Inventory Form contains a map of the site, as well as other geographic information.

11.2.2.10 PHOTOGRAPHS

Photographs of JM043 are on file with the COE.

11.2.2.11 INDIVIDUALS COMPILING DOCUMENTATION

The historical research and evaluation of JM043 was conducted by Paul D. Friedman, of Science Applications, Inc.

11.3 IDENTIFICATION OF ADVERSE IMPACT

The John Martin Reservoir is a multiple-purpose facility including water impoundment for downstream irrigation, flood control, and recreation. Accordingly, there are many differing kinds of effects which adversely impact cultural properties and resources. These include the natural forces of wind and water erosion, annual activities, vandalism, recreational activities, ranching and farming, lake management, as well as the historical fact of the original dam construction.

Because of their location, some sites are more affected by the natural forces of wind and water erosion than others. This is especially true of sites located on hillsides, on the sides of drainages, or in the stabilized dune areas, on the south side of the reservoir. Such factors as sand blown by wind over a site may obscure it or disturb the distribution of artifacts. Erosion due to water runoff also may disturb the pattern of artifact distribution at a site. Another natural factor to be considered is the burrowing of animals, especially small rodents. Rodent holes were noted at a number of sites. Sometimes animal activity can also disturb a site by shifting artifacts, and burrowing through subsurface deposits, ruining the natural stratigraphy.

During the course of the archeological survey, evidence of site vandalism was noticeable including the unauthorized digging ("point hunting") and the collecting of surface artifacts. Particularly, the townsite of Old Las Animas, JM043, has been badly excavated by amateur bottle collectors resulting in confusion of structures and disturbing stratigraphy of historic trash deposits. Collecting of projectile points and to a lesser degree other finished stone and ceramic artifacts, has seriously depleted the information content of many of the surface lithic scatter sites. Today these time-sensitive artifact classes, which were so sorely needed in the investigation of the evolutionary hypotheses, are to be found in the hands of local collectors of which large collections are on display at the Kit Carson Museum and in the lobby of the First National Bank of Las Animas.

Another impact on the cultural properties of the reservoir area is caused by a variety of recreational activities. Among these are off-road traffic by camper and trailer vehicles, camping by fishermen and boaters, the construction of pit-type blinds by duck and geese waterfowl hunters, and the construction of picnic facilities. All of these activities, both authorized and unauthorized, occasionally disturb the spatial patterning of archeological sites and potentially disrupt the integrity of subsurface archeological deposits.

Of a more serious nature are leasing activities of ranching and farming as these affect archeological sites. These authorized agricultural ventures take place on federally owned land within the project perimeter. A substantial portion of the reservoir is licensed to the State Division of Wildlife for use as a game refuge. Some agricultural plots are used for feeding of the waterfowl. Additionally there were, at one time, commercial grazing leases, but this practice has been discontinued. The grazing of cattle causes damage to artifacts by displacement and actual breakage of specimens. Farming is of a more destructive nature due to plowing which not only

displaces surface artifacts but also destroys architecture and overturns below ground archeological deposits.

The adverse effect of dam-controlled fluctuations in water levels is a further factor impacting the quality of the John Martin cultural remains. As a rule, the lake is most full in the spring following the melt and runoff of snowpack from the mountainous headwaters of the Arkansas River. Following this filling, the lake level drops as water is released for downstream irrigation use and to provide storage capacity for unexpected flood crests. Since dam construction in 1948, there has been significant fluctuation in lake level so that shoreside archeological sites are twice annually covered and uncovered by the rising and falling of the lake waters. This action has effectively destroyed most fine occupational sediments such as prehistoric midden and hearth charcoal. Further, the cyclical wetting and drying will help to destroy all perishable artifacts including bone refuse, both animal and human in origin. Another agent of site destruction is the wave action as the shoreline shifts over the site. Particularly, when the wind is strong causing choppy swells, the mechanical rolling of shoreline artifacts will cause specimen displacement and abrasive rounding with a consequent loss of distributional and formal attribute information.

The sites most likely to be affected by fluctuations in the level of the reservoir are those located below the high-water mark (3850 ft.), and on the edges of drainages and tributaries of the Arkansas River, such as Rule Creek, McRae Arroyo, and Gageby Creek.

Finally, a list of constructional activities has served to impact the reservoir archeological sites. These include the original construction of the John Martin dam as well as a host of related features such as COE offices, support facilities, borrow pits, relocation of highways and the rail line, roads, and the clearing of the reservoir basin, itself. Further, cultural resource activities include new picnic shelters, lake access roads, and powerlines over utility easements, and gravel pits and quarries.

Adverse impacts have been identified for each individual site on Table 11.2. These impacts may reflect past actions, such as erosion or animal burrowing which has already altered the artifact pattern of the site. Sites damaged by construction activities are also considered an action of the past. In addition, there are concerns about future threats to resources, specifically recreation and vandalism. COE management strategies for the project area, including designated recreation areas, could affect the potential adverse impact of sites in those areas.

11.4 RECOMMENDED MANAGEMENT STRATEGIES

Table 11.2 identifies sources of adverse impact and site-specific management data. It gives for each sites its: (1) property name; (2) adverse impacts, and (3) recommendations. The first column, property name, lists each site by its temporary John Martin number (JM. . .), followed by its permanent Smithsonian trinomial designation (5BN. . .) as issued by the State Preservation Office, and for known historic sites, the name of the homesteader or property owner. The next column identifies past or potential adverse impacts. These include inundation, erosion, animal activity, vandalism, construction, and recreation. The recommendations tell what work has been completed at a site, recommendations for future work, and the priority ranking for each site. In the case of work completed, all sites were recorded (i.e., State of Colorado Inventory Forms were filled out), almost all were mapped, and a few were subject to limited collection. Only three sites were test excavated (see Section 5.6). The recommendations are based upon the field crew's suggestion for mitigation strategy. In almost all cases, avoidance is recommended. The

terms of their size, in square meters, features, and clusters. The clusters specifically refer to artifact concentrations at a site as defined by the intrasite Nearest Neighbor and NTSYS analyses. A symbol of NA means that the artifact distribution was not analyzable, which was always the case for the historic sites because they were treated in a manner different from the prehistoric sites. The lack of a cluster count for prehistoric sites indicates that the artifact distribution was without internal clustering. Cultural affiliation in Column 5 specifies whether the site is prehistoric, historic, or both (i.e. double component). If the age of the componenet is known, the dates of occupation are given. The next column identifies past or potential adverse impacts. These include inundation, erosion, animal activity, vandalism, construction, and recreation. The recommendations tell what work has been completed at a site, recommendations for future work, and the priority ranking for each site. In the case of work completed, all sites were recorded (i.e. State of Colorado Inventory Forms were filled out), almost all were mapped, and a few were subject to limited collection. Only three sites were test excavated (see Section 5.6). The recommendations are based upon the field crew's suggestion for mitigation strategy. In almost all cases, avoidance is recommended. The term NFW refers to the recommendation that no further work be done at the site. This recommendation is most commonly applied to the historic sites, which have been fully recorded in terms of their physical attributes and archival background. The priority rankings are based upon Table 11.1, which demonstrated which sites hold potential for future research. The full description of these rankings can be found in Section 11.1.1. Most of the historic sites received the lowest rank because they were deemed not eligible for recommendation to be nominated to the NRHP, as explained in Section 11.1.2.

In order to mitigate the effect of the adverse impacts described in Section 11.3, a multi-part program of culture resource management is recommended. Some of the actions which we feel could preserve or lessen the rate of destruction include: 1) the posting, patrol, and fencing of sites, 2) a policy of avoidance or mitigation of sites to be effected by planned construction, and 3) control of adverse effects resulting from lease permits.

The post-patrol-fencing option could fairly easily be put into practice by training the existing ranger-law enforcement staff of the COE. An enlightened ranger force, taught to recognize and appreciate cultural resources, could make effective public contact while on routine patrol thereby stopping site looting while it is in progress. Further discouragement of collectors could be effected through public talks at civic clubs and in the surrounding school systems. This educational program should be backed by posted signs to appear on the COE perimeter boundary warning visitors not to harm, deface, or collect from lithic scatters, rock art panels, rock overhangs, or historic remains. Finally, a site such as JM043, Old Las Animas, should be fenced with warning signs prohibiting entry and looting.

A second avenue of culture resource management could be brought about in the planning stage for new construction. Before the construction of a reservoir facility such as buildings, picnic area, access roads, or other developments, the records covering the presence of prehistoric and historic remains should be consulted. Next a qualified archeologist should inspect the planned construction site for the presence of culture resources. If any are found, it may be possible for the design engineers to adjust the construction plan so as to avoid adverse impact. Barring this favored option, the effects on the culture resource should be mitigated by a planned strategy of data recovery executed well before construction begins. For sites deemed eligible for the NRHP, the 106 process must be adhered to according to the Historic Sites

Preservation Act of 1966 (Schiffer and Gummerman 1977). When all three parties--COE, SHPO, and the Advisory Council on Historic Preservation--are in agreement, then a mitigation program of controlled artifact collection, excavation, or other form of data recordatic- should be carried out.

Finally, management of culture resources can be made through a COE policy to control the activities of farmers and ranchers who lease federally owned lands within the project boundary. Such agricultural land-use permits should carry one or more stipulations restricting grazing and/or plowing in such a way as to effectively stop impact on culture resources. Cattle could be fenced off archeological sites or cropping restricted to areas other than those with cultural properties.

There is one other important management recommendation to be made. Should the site of the town of Old Caddoa ever appear above the waterline, the COE is urged to record it immediately and evaluate its significance in terms of the criteria for nomination to the National Register of Historic Places. The town of Caddoa was platted in 1887 and was located in the SE¼ of Section 12, T23S, R50W. It served as a local marketplace and shipping point on the Santa Fe Railroad but never developed into a sizable community. In 1900 there were 223 people listed on the U.S. census as living in Caddoa. Most of these people were involved in either agricultural pursuits or were associated with the railroad. The town was slated for evacuation in 1941 due to the construction of the John Martin Dam. A few of the buildings were moved by the Corps of Engineers to a new location southeast of the dam, and the old town site was inundated as the waters of the reservoir rose.

SECTION 12.0
APPENDIX A
SURFICIAL GEOLOGY AT THE JOHN MARTIN RESERVOIR
by Vance T. Holliday

The John Martin Reservoir area is within the High Plains section of the Great Plains physiographic province. This extensive, nearly level area is underlain by approximately horizontal Mesozoic, generally Cretaceous, sedimentary rocks capped by Tertiary sediments, derived principally from the Rocky Mountains (Hunt 1967). Of primary geologic interest to archeological investigations along the Arkansas River are the latest Pleistocene and Holocene deposits, geomorphic surfaces, and soils since these periods encompass the known range of human occupation in the area (12,000 B.P. to present). In order to review pertinent geologic investigations in the project area, late Quaternary investigations in eastern Colorado in general need to be reviewed as it is in other areas of the region that the geochronologic framework and stratigraphic terminology has been defined.

12.1 EASTERN COLORADO

Most of the late Quaternary stratigraphic investigations in eastern Colorado have been along the South Platte River, some of its tributaries in eastern Colorado, and the major drainages of Kansas and Nebraska. Some limited work has been done in filled playas, and dunes on the Arkansas River (Figures 12.1 and 12.2). The late Quaternary stratigraphy of the South Platte was originally defined near Denver (in the Kassler area) by Hunt (1954) and Scott (1963, 1965) based on a series of fill terraces, soils, and eolian deposits. This sequence has been widely used throughout the region and has been refined by Machette (1975), Gardener (1967), and Holliday (n.d.). In Kansas and Nebraska, Schultz and Martin (1970) have presented a revised and refined late Quaternary chronology based on considerable earlier work (Frye and Leonard 1952; Schultz and Stout 1945, 1948; Schultz et al. 1951; Thorp et al. 1951).

Scott identified two late Pleistocene valley fills and terraces on the South Platte: Louviers, dating older than 12,000 B.P. and Broadway, dating between 12,000 and 8500 B.P.; the two units are separated by formation of a "Wisconsin soil." Machette, working in the Lafayette area, near Boulder, has revised these ages based on radiometric dates and pedogenesis. The Louviers is dated between 120,000 and 75,000 B.P. and the Broadway greater than around 12,000 to 10,000 years ago. Near the Greeley-Kersey-Ft. Morgan area the correlative to the Broadway terrace is the Kersey (Bryan and Ray 1940; Gardener 1967; Holliday n.d.; Scott 1963). Here Clovis archeological material has been recovered from near the top of the alluvium (Frank Frazier, pers. comm.; Holliday, n.d.,) and Folsom, Agate Basin, and Kersey archeological material (11,000-9000 B.P.) has been found on top of the terrace (Roberts 1937; Wheat 1979). This dates the end of Broadway/Kersey deposition to around 11,000 years ago. In Nebraska and Kansas, Schultz and Martin have identified the T-2 terrace complex dating at around 12,000 years and older, capped by the Brady soil (Soil YY) dating between 12,000 and 10,000 years ago. The T-2 complex would seem to be a probable correlative of the Broadway.

The next youngest unit of Scott's is the pre-Piney Creek alluvium, dating at greater than 4500 years ago. In no other area in the region has a unit of similar age and position been identified. Eolian deposits on top of the Broadway but older than 5000 B.P. were also identified by Scott. In the Greeley area, Holliday identified dunes covering Paleo-Indian sites on the Kersey terrace,

FIGURE 12.1
PHYSIOGRAPHIC MAP OF EASTERN COLORADO
JOHN MARTIN RESERVOIR PROJECT

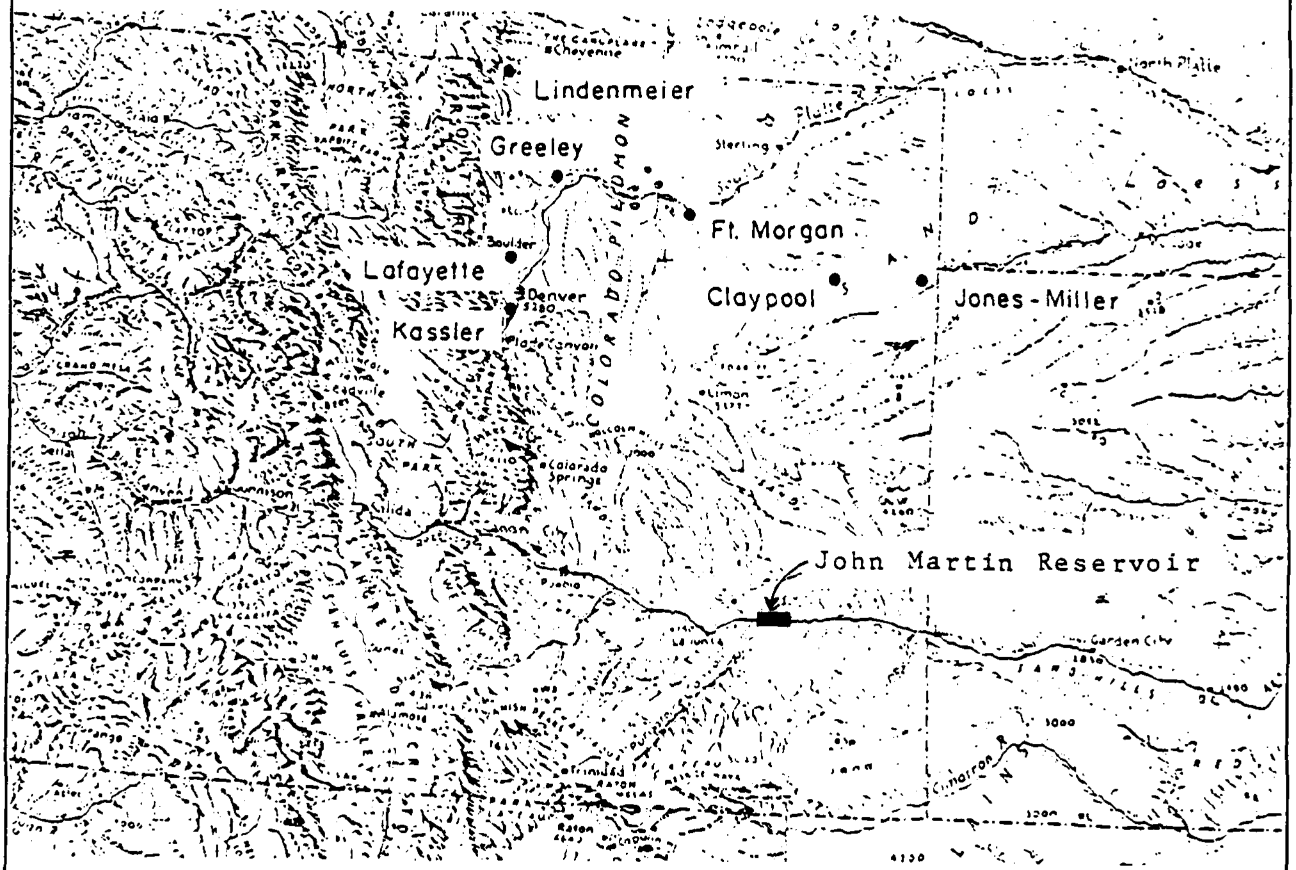
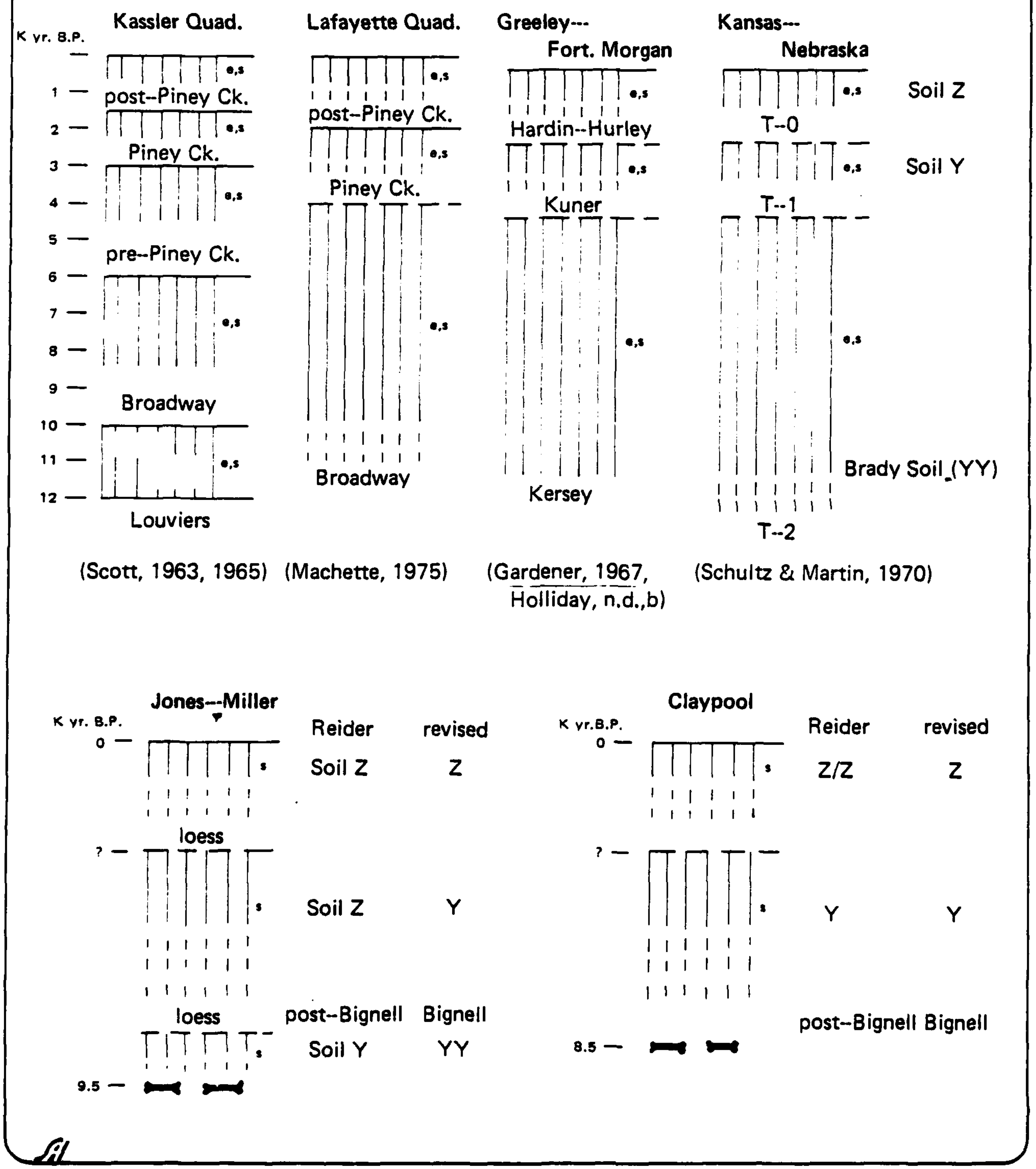


FIGURE 12.2
CORRELATION CHART OF LATE QUATERNARY STRATIGRAPHY IN EASTERN COLORADO
JOHN MARTIN RESERVOIR PROJECT



topped by a soil and more dunes which may be correlative to Scott's early Holocene dunes. In Kansas and Nebraska the early Holocene Bignell loess (with Soil Y) is identified on the T-2 surface.

The principal Holocene unit mapped for the South Platte is the Piney Creek, originally dated by Scott at greater than 1500 years old. Machette dates the Piney Creek as "middle Holocene," perhaps 3000 years old or more. East of Greeley, on the correlative terrace, the Kuner, Holliday reports archeological material dating to around 3500 B.P. The T-1 surface in Kansas and Nebraska also dates to around 3500 years old. On top of the Piney Creek terrace Scott describes loess and eolian sands of late Holocene age. These may be correlates of the younger dunes found above the early Holocene dunes and soil in the Greeley area. Late Holocene loess (with Soil Z) is reported from the Central Plains on top of T-1 and the Bignell loess.

The youngest alluvium in the area is the post-Piney Creek, dated by Scott at no more than 1500 years old. Archeological material from the correlative terrace near Greeley (Hardin terrace near Kersey, Hurley terrace near Ft. Morgan) corroborates this age estimate. The T-0 fill in Kansas and Nebraska is also of the same age.

On the plains of eastern Colorado preliminary geological investigations, as part of recent archeological work, have been carried out in several small basins. At the Jones-Miller site three loess deposits, separated by weak soils (A-C profiles), have been identified by Reider (in press, a). Just below the A horizon of the basal loess a bone bed of *Bison antiquus* remains, in association with Agate Basin points (ca. 9500 B.P.) has been excavated. Reider has correlated the soil above the bone bed with Soil Y of the Central Plains to the east. This implies that the sediments covering the bone bed are considered to be correlatives of the Bignell loess as defined by Schultz and Martin (1970). However, in references cited by Reider, none more recent than the mid-1950s, the soil developed on the Bignell was identified as Soil YY, and the entire unit was considered the bone bearing loess to be post-Bignell. Given that the Bignell is now considered early Holocene the overlying loess may be more properly considered the Bignell correlate, with the Soil Y correlative formed therein. Furthermore, this unit, above the bone bed, may correlate with the early Holocene eolian deposits along the South Platte River. Reider has correlated the soil in the uppermost loess with Soil Z'. In Schultz and Martin's revised stratigraphy this soil is no longer defined. The uppermost loess at Jones-Miller, then, may correlate with Soil Z.

At the Claypool site Reider (in press, b) had identified two eolian deposits separated by a buried soil. Below the buried A horizon is a *B. antiquus* bone bed with Cody Complex material dated at 8500 years old. Malde (1960) correlated this lower eolian unit with the Bignell loess. Reider considered the unit to be post-Bignell since the references cited considered Bignell to be late Pleistocene. For the reasons cited above this unit may well be the Bignell loess correlate since it is now considered to be early Holocene. The soil on the overlying loess may then be a correlate of Soil Z.

12.2 ARKANSAS RIVER

The most detailed geologic studies on the Arkansas River on the plains of eastern Colorado have been in the Pueblo area. Scott (1964, 1969a, 1969b) and Scott et al. (1978) have mapped Broadway alluvium, early Holocene eolian sands, Piney Creek alluvium, late Holocene sands, and post-Piney Creek alluvium based primarily on comparisons of soil development between the Pueblo area and the type localities. There is no archeological or radiometric information available for these deposits. To the east mapping on 1°-by-2° sheets has been completed

for the Lamar (Sharps 1976) and La Junta (Scott, 1968) quadrangles. General reports on geology and groundwater resources have been compiled for Otero and southern Crowley counties (Weist 1965) and Prowers County (Voegeli and Hershey 1965). Soil surveys of Otero (Larsen et al. 1972) and Prowers (Pannell et al. 1966) counties to the west and east of the project area respectively, have useful geologic cross sections of the Arkansas River valley (Figures 12.3 and 12.4). The most up-to-date geological information for the John Martin reservoir area is available on the Lamar quadrangle by Sharps (1976).

The Bent County area is generally underlain by slightly north-dipping lower Cretaceous Dakota sandstone and upper Cretaceous Graneros shale, Greenhorn limestone, Carlisle shale, Niobrara Formation shales and limestones, and Pierre shale. In some areas these units are unconformably overlain by Ogallala Group (Pliocene) sands and gravels. In the immediate area of the reservoir, the principal bedrock units are the Dakota sandstone, Graneros shale, Greenhorn limestone, Carlisle shale, and Niobrara Formation. These units have been slightly folded by Las Animas arch, a north-south trending anticline. Gageby Creek roughly follows the fold axis (Sharp 1976; Tweto, 1979; Figure 12.5).

All along the Arkansas River downstream from Pueblo, both the Louviers and Broadway alluvium have been mapped as well as late Pleistocene and Holocene eolian deposits and Piney Creek series alluvium and terraces, based on Scotts' identification of these units in the Pueblo area. The use of this stratigraphic nomenclature on the Arkansas is not advisable, however, since there is no absolute age control available for the area. Furthermore, the units are originally defined for another major drainage system. Both the Arkansas and South Platte emanate from a number of different glaciated mountain ranges and would be subject to local and regional variations in glacial and interglacial cycles as well as variations in cutting and filling cycles along tributaries. The terrace sequences along each river may well be out of phase. Additionally, moving downstream from Pueblo toward the project area the terraces may converge or diverge, depending on variations in local and regional base levels and the timing of uplift on the Las Animas arch.

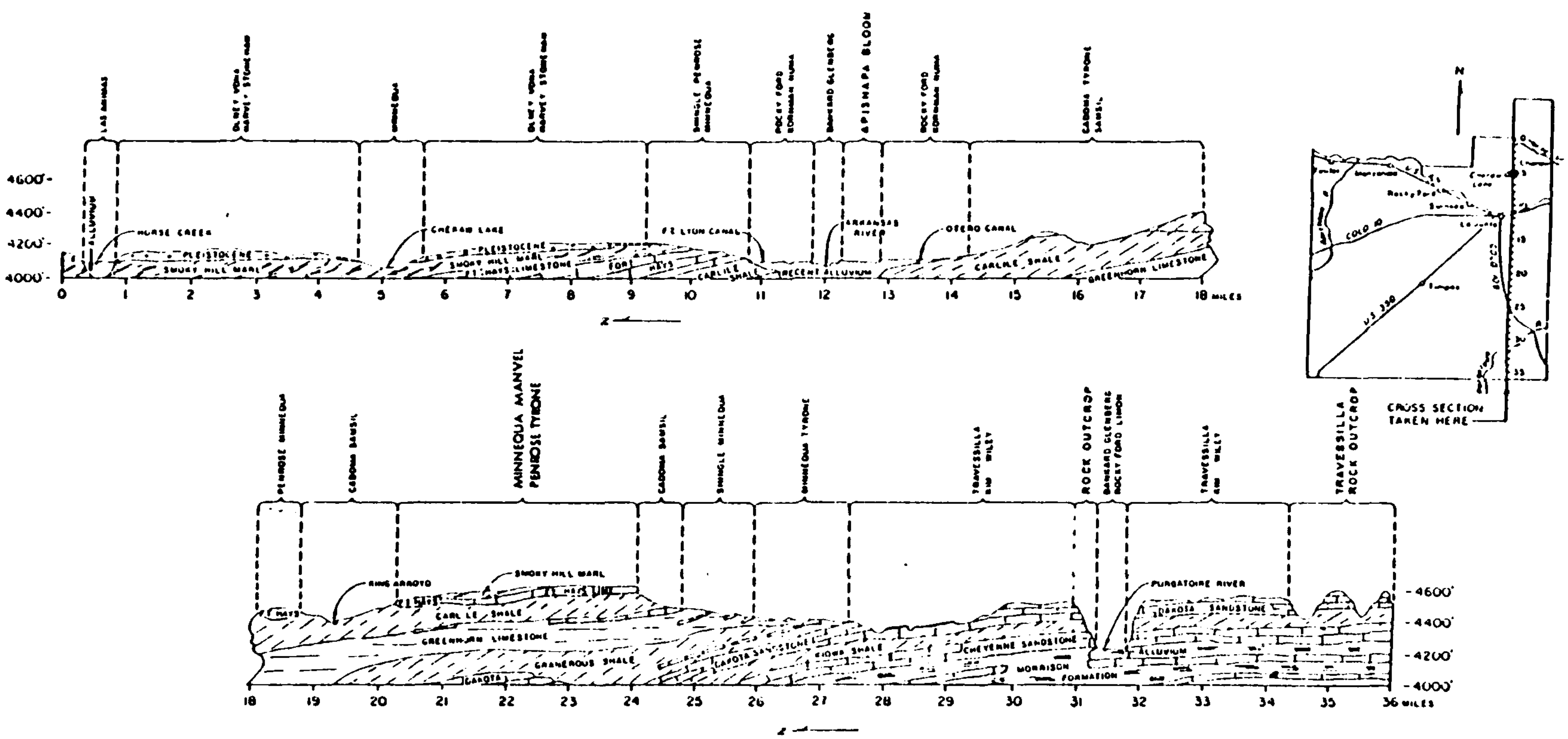
Soil surveys have been carried out all along the Arkansas River in eastern Colorado. Sweet and Inman (1926) published a general soil survey of the entire river valley from Canon City to the Kansas border. This may provide valuable information concerning the topography of the reservoir area prior to the construction of the dam. More recent, detailed soil surveys have been published for the Pueblo area (Larsen et al. 1979) and Otero (Larsen et al. 1972), Crowley (Larsen et al. 1968), Bent (Preator et al. 1971), and Prowers (Pannell et al. 1966) counties.

12.3 GEOLOGIC INVESTIGATIONS IN JOHN MARTIN RESERVOIR

The primary goal of the geologic investigations at John Martin Reservoir was the interpretation and correlation of sediments, soils, and geomorphic surfaces pertinent to the archeological investigations and the establishment of the local geochronologic framework. Such information could aid in dating archeological sites, accurately defining their geomorphic setting, evaluating the geologic significance of sites found within the area affected by repeated inundation due to the rising and lowering of the reservoir.

The geologic investigations were carried out by field inspection of the project area, examining aerial photos and topographic maps, and reviewing pertinent soil surveys and geologic literature. Several specific endeavors valuable to the geologic interpretations were the detailed examination and description of several soil

FIGURE 12.3
CROSS SECTION OF OTERO COUNTY
JOHN MARTIN RESERVOIR PROJECT

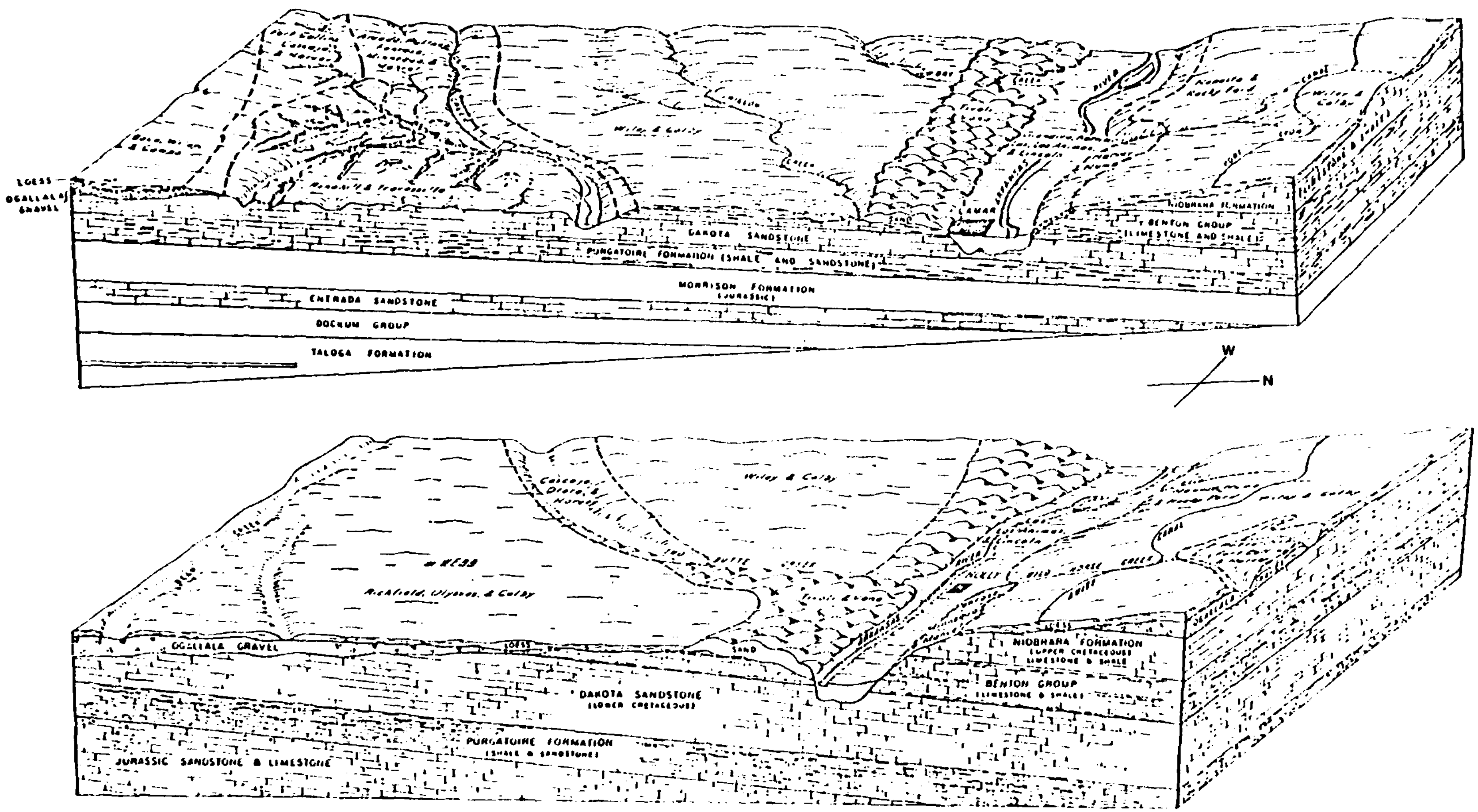


Cross section shows relief, drainage, and relation of soils to underlying geologic formations.
(From Otero County Soil Survey)

FIGURE 12.4

CROSS SECTIONS OF PROWERS COUNTY

JOHN MARTIN RESERVOIR PROJECT



Shows relationships of the soils to the landscape and to the underlying geologic formations. The upper cross section shows relationships in the western part of the county, and the lower shows those in the eastern part of the county. (From Prowers County Soil Survey)

FIGURE
GENERALIZED SUR
JOHN MARTIN RES

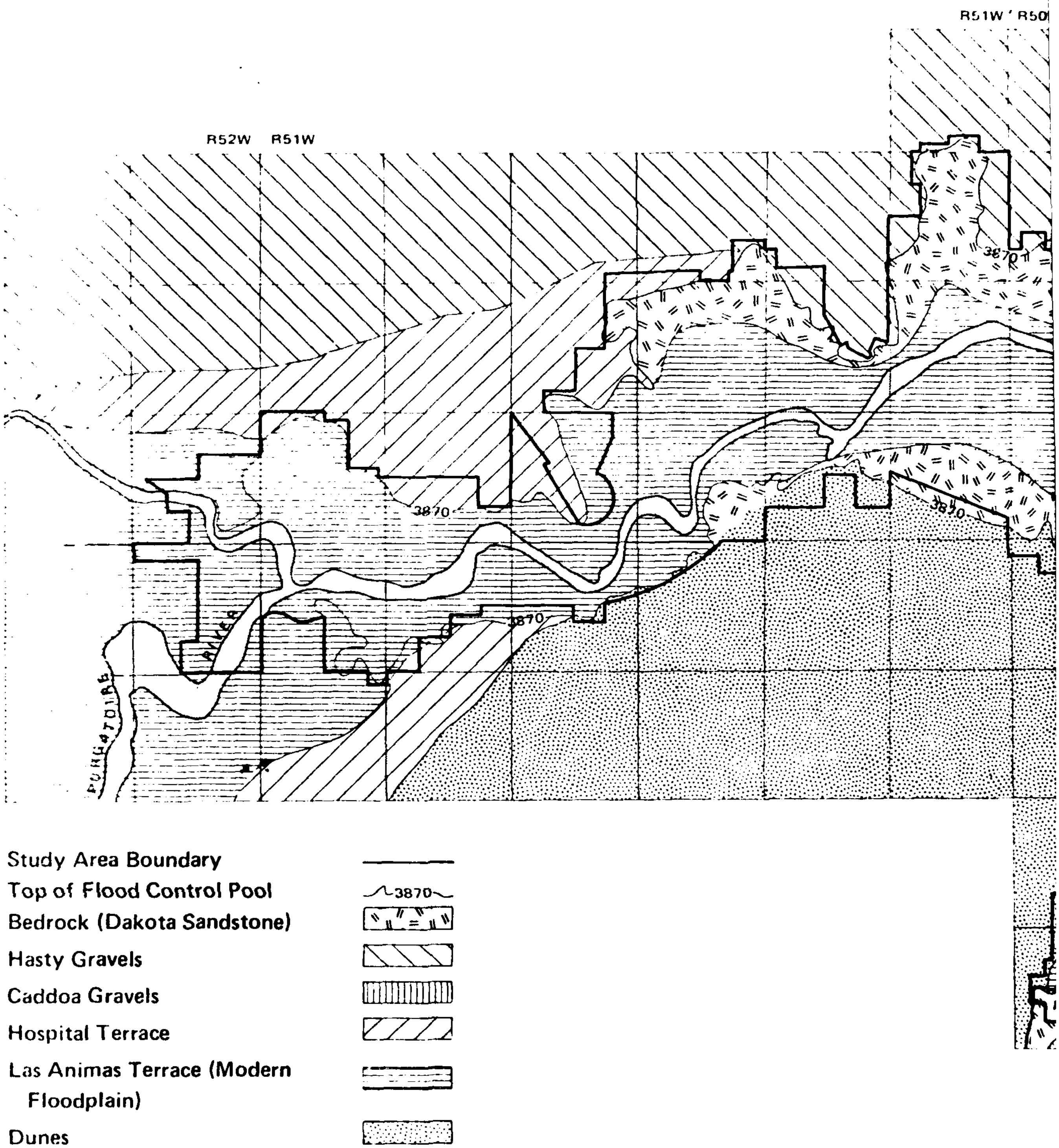
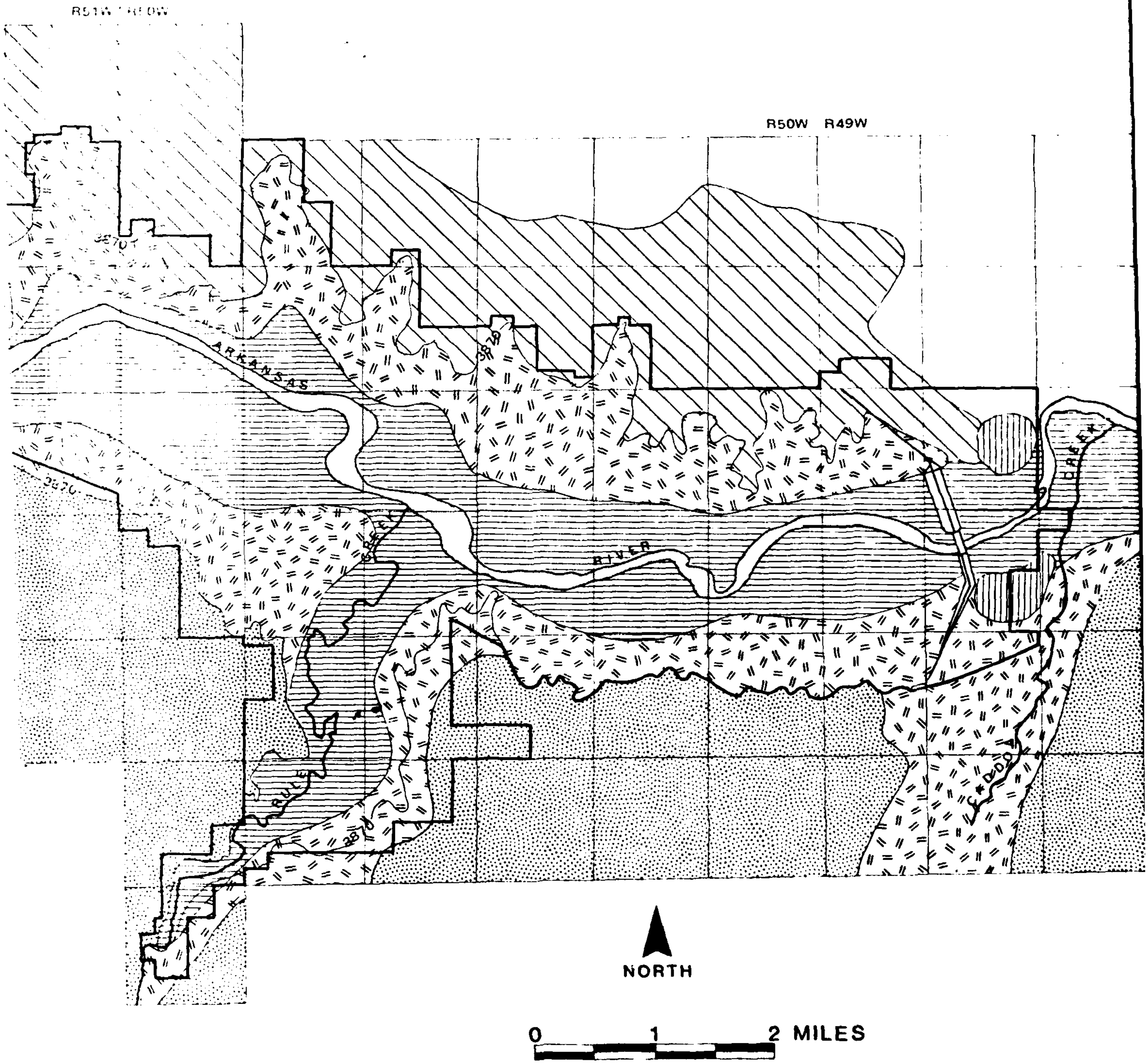
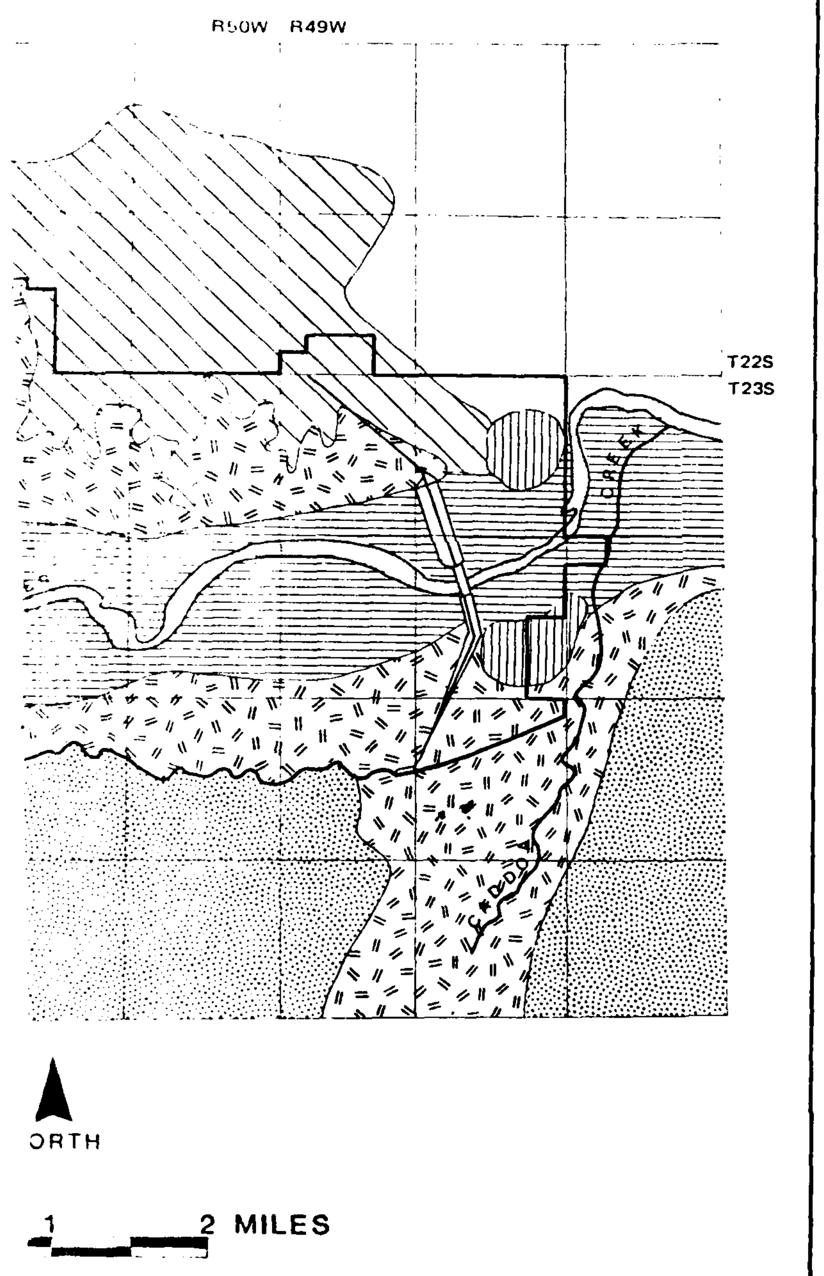


FIGURE 12.5
ALIZED SURFICIAL GEOLOGY
ARTIN RESERVOIR PROJECT




R50W R49W
T22S
T23S
CREEK
CADDOA
ORTH
1
2 MILES

profiles (Tables 12.1-12.4) and the construction of stream terrace profiles using 1:10,000 (5 ft. contour interval) and 1:24,000 (10 ft. contour interval) topographic maps (Figure 12.6).

12.3.1 QUATERNARY STRATIGRAPHY

Two principal Quaternary deposits and associated gemorphic surfaces were identified in the project area: alluvial deposits of the Arkansas River and eolian deposits and dunes. The alluvial deposits and terraces are apparent along both sides of the river but considerably more obvious on the north side owing to the eolian deposits and dunes being confined to the south side and thus obscuring the stream features. In the following discussion the alluvial features reviewed are those examined on the north side unless otherwise noted.

Four major alluvial deposits and terraces were identified in the project area. Rather than use the terminology of Sharps (1976) for reasons cited above, the surfaces and sediments have been given new, informal names (from oldest to youngest); Hasty, Caddoa, Hospital, and Las Animas (Figures 12.5 and 12.6).

12.3.1.1 THE HASTY SURFACE

The Hasty surface stands at an average height of 150 to 170 ft. above the Arkansas at an elevation of about 4000 ft. due north of Las Animas, sloping to about 3930 ft. between the dam and the small town of Hasty north of the dam. Hasty deposits generally consist of gravels 80-100 ft. thick composed of well-rounded cobbles of quartzite, sandstone, and some igneous rocks.

The cobbles in the upper 10-20 ft. of the deposit commonly have thick (1-10 mm) coatings of calcium carbonate ($CaCO_3$) on their undersides (Table 12.1). This is considered to be a Cca soil horizon (intermediate between Stages I and II of the calcic horizon developmental scheme of Gile et al. 1966, modified by Bachman and Machette 1975). The A and B horizons of the soil associated with the Cca appear to have been removed in the project area. In some areas a silt deposit over 5 ft. thick with a well-developed soil (A/Bt/Cca, Stage II horizonation Table 12.2) overlies the cobbles. The fine texture of this material suggests that it is a younger deposit of probable eolian (loess) origin rather than alluvial sediments associated with the cobbles.

Subsequent to the development of the $CaCO_3$ coatings, the Hasty surface was beveled down to form a long gently sloping surface (Figure 12.6). This erosion has exposed the $CaCO_3$ encrusted gravels throughout the project area on the north side of the reservoir. The slope of this beveled surface is so low as to give the impression of numerous terraces between the Hasty and Caddoa surfaces on large-scale topographic maps. Gravel capped bedrock benches, particularly between Gageby Creek and the dam, at about 80-120 ft. above the river also give the impression of terraces. The gravels are simply the remains of the lower Hasty deposits resting on bench like outcrops of Dakota Sandstone. Radiometric dating of Verdos and Slocum alluvial deposits provides ages to 600,000 and 100,000 B.P. respectively (Machette 1975). Field and aerial photo investigations suggested no criteria for differentiating these deposits from the Hasty gravels. The material had similar lithology, texture, and roundness. Soil development in the form of $CaCO_3$ coatings was also quite similar, suggesting similar age. However, deposits rest on Dakota Sandstone outcrops which do give the suggestion of terraces.

12.3.1.2 THE CADDOA SURFACE

The Caddoa surface and deposits were observed only in the area immediately downstream from the dam on both sides of the river at about 40-50 ft. above the river (Figure 12.5).

TABLE 12.1 HASTY GRAVELS

AREA John Martin Reservoir	DATE 20 Jan. 1981	STOP NO.
CLASSIFICATION		
LOCATION John Martin Reservoir area, ca. 2.5 mi southwest of Hasty CO		
N. VEG. (or crop)		CLIMATE semiarid
PARENT MATERIAL coarse alluvium, ca, 60%+ cobbles		
PHYSIOGRAPHY eroded fill terrace		
RELIEF moderate	DRAINAGE good	SALT OR ALKALI
ELEVATION 3870 ft.	GR. WATER	STONINESS
SLOPE	MOISTURE	
ASPECT	ROOT DISTRIB.	% CLAY *
EROSION	% COARSE FRAGMENTS *	% COARSER THAN V.F.S.*

HORIZON	DEPTH (cm)	COLOR		TEXTURE	STRUCTURE	CONSISTENCE			REACTION	BOUNDARY	
		DRY	MOIST			DRY	MOIST	WET			
A1	0-20	10 YR 6/3	10 YR 4/2	Gr,L	m	Sh	fr		--	c,s	Modern A horiz. formed in old gravels
AC	20-40	10 YR 6/2	10 YR 5/3	Gr,L	m	so	fr		vs	c,s	
C1ca	40-80	10 YR 7/3	10 YR 6/3	Gr,S	m				vs	c,s	5-10 cm $CaCO_3$ coats under cobbles Calcic horiz. Stage I-II
C2ca	80-200+	10 YR 7/3	10 YR 6/3	Gr,S	m				vs		

Legend

Color - Munsell system

Texture - Gr = gravelly, S = sand, Si = silt, L = loam, SiL = silt loam
LS = loamy sand, LfS = loamy fine sand, CL = clay loam

Structure - wk. = weak, mod. = moderate, st. = strong, f. = fine, m. = medium,
c. = coarse, Lo. = loose, sab = subangular blocky,
pr. = prismatic, M = massive

Consistence - so = soft, sh = slightly hard, h = hard, vh = very hard,
fr = friable, vfr = very friable

Reaction (w/HCL) - s = strong, vs = very strong

Boundary - a = abrupt, c = clear, d = diffuse, s = smooth, w = wavy

TABLE 12.2 LOESS OVER HASTY GRAVELS

AREA John Martin Reservoir	DATE 20 Jan. 1981	STOP NO.
CLASSIFICATION		
LOCATION John Martin Reservoir area, ca. 1.5 mi southwest of Hasty		
N. VEG. (or crop)		CLIMATE semiarid
PARENT MATERIAL wind blown silts (loess)		
PHYSIOGRAPHY		
RELIEF low	DRAINAGE	SALT OR ALKALI
ELEVATION 3930 ft.	GR. WATER	STONINESS
SLOPE	MOISTURE	
ASPECT	ROOT DISTRIB.	% CLAY *
EROSION	% COARSE FRAGMENTS *	% COARSER THAN V.F.S.*

HORIZON	DEPTH (cm)	COLOR		TEXTURE	STRUCTURE	CONSISTENCE			REACTION	BOUNDARY	
		DRY	MOIST			DRY	MOIST	WET			
A1	0-7	10 YR 6/2	10 YR 4/2	Si,L	wk., f., gr.	so	vfr		--	c,s	
B1	7-15	10 YR 5/2	10 YR 4/2	Si,L	mod., f.sab	h	fr		--	c,s	few thin clay films
B25	15-25	10 YR 6/3	10 YR 4/3	Si,L	wk., m.sab	sh	fr		vs	c,s	few thin clay films
B_3ca	25-32	10 YR 6/3	10 YR 5/3	Si,L	wk., c.pr.	sh	fr		vs	c,s	Stage I calcic horiz.
Cca	32-150+	10 YR 6/3	10 YR 5/3	Si,L	m	sh	fr		vs		Stage I-II calcic horiz.

TABLE 12.3 HOSPITAL SURFACE

AREA John Martin Reservoir	DATE 20 Jan. 1981	STOP NO.
CLASSIFICATION		
LOCATION ~~John Martin Reservoir area, ca. 1.5 miles west of V.A. Hospital~~		
N. VEG. (or crop)	CLIMATE Semiarid	
PARENT MATERIAL fine-grained alluvium (silts and sands)		
PHYSIOGRAPHY eroded terrace scarp		
RELIEF moderate	DRAINAGE	SALT OR ALKALI
ELEVATION 3880 ft.	GR. WATER	STONINESS
SLOPE	MOISTURE	
ASPECT	ROOT DISTRIB.	% CLAY *
EROSION	% COARSE FRAGMENTS *	% COARSER THAN V.F.S.*

HORIZON	DEPTH (cm)	COLOR DRY	COLOR MOIST	TEXTURE	STRUCTURE	CONSISTENCE DRY	CONSISTENCE MOIST	CONSISTENCE WET	REACTION	BOUNDARY	
A1	0										A horizon not apparent (eroded)
B2	0-60	10 YR 6/3	10 YR 4/3	Si,L	st., pr., wk., sab				--		
Clox	60-75	10 YR 6/4	10 YR 4/4	LS	wk., sab.				--		
C2ca	75-100	10 YR 6/4	10 YR 4/4	LS	wk., sab.				s		10-20% finely divided $CaCO_3$ (Stage I)
C2ca	100-125	10 YR 6/2	10 YR 5/3	Gr,S	Lo.				vs		30-40% finely divided $CaCO_3$ (Stage I-II)
C3ca	125+	10 YR 6/2	10 YR 5/3	Gr,S	Lo.				vs		50%+ finely divided $CaCO_3$ (Stage I-II)

TABLE 12.4 OLDER DUNES

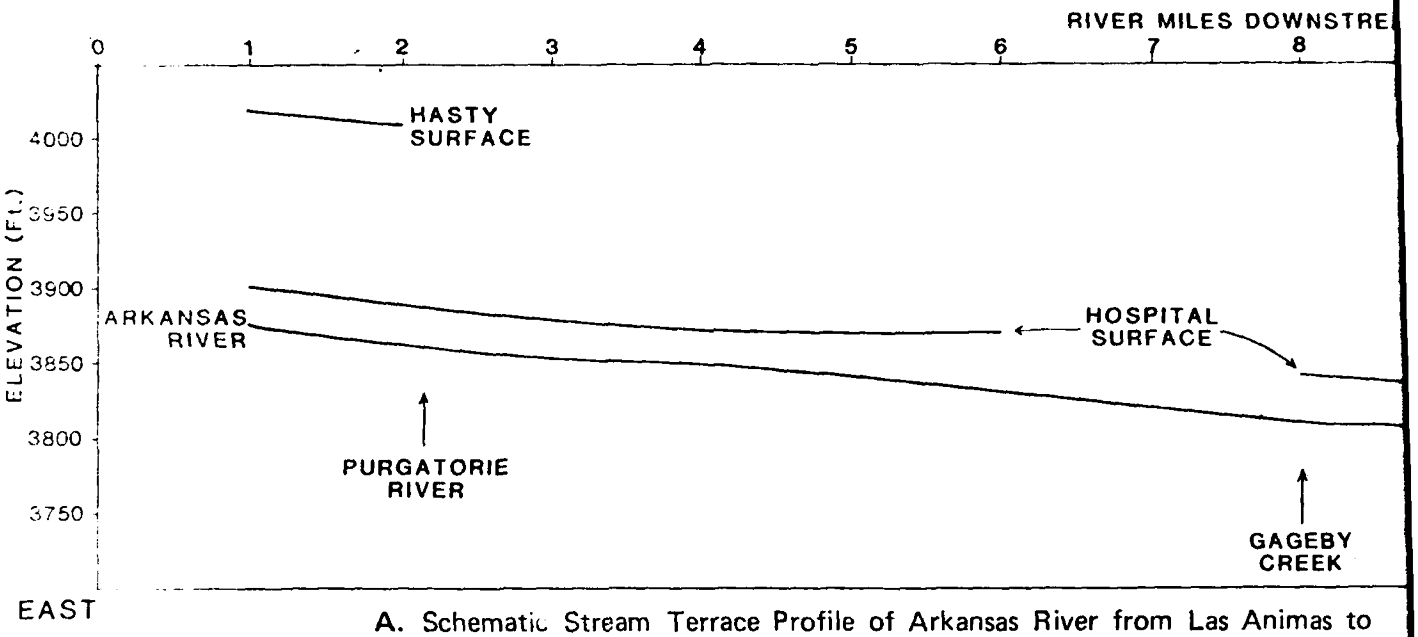
AREA John Martin Reservoir	DATE 20 Jan. 1981	STOP NO.
CLASSIFICATION		
LOCATION John Martin Reservoir area, RR cut ca. 2 mil WNW of Rule Ck. RR trestle		
N. VEG. (or crop)	CLIMATE semiarid	
PARENT MATERIAL mid-Holocene Dune sands		
PHYSIOGRAPHY Rolling dune fields		
RELIEF moderate	DRAINAGE	SALT OR ALKALI
ELEVATION 3880 ft.	GR. WATER	STONINESS
SLOPE	MOISTURE	
ASPECT	ROOT DISTRIB.	% CLAY *
EROSION	% COARSE FRAGMENTS *	% COARSER THAN V.F.S.*

HORIZON	DEPTH (cm)	COLOR DRY	COLOR MOIST	TEXTURE	STRUCTURE	CONSISTENCE DRY	CONSISTENCE MOIST	CONSISTENCE WET	REACTION	BOUNDARY	A horizon eroded
B2	0-52	10 YR 4/3.5	10 YR 3/3.5	LS	wk., m., sab	sh			--	c,w	hues tend to 7.5 yr
C1ca	52-75	10 YR 6/4	10 YR 5/4	LS	wk., m., sab	h			s	a,w	v.finely divided $CaCO_3$ throughout some bedding apparent
C2ca	75-125	10 YR 7/3	10 YR 5/3.5	LS	m.	h,vh			vs	c,s	$CaCO_3$ v.finely divided throughout (Stage I-II?)
C3ca	125-165	10 YR 6/3	10 YR 5/4	LfS	wk., m., sab	sh			s	d,s	$CaCO_3$ v.finely divided throughout
C4ca	165-210+	10 YR 6/3	10 YR 5/4	LfS	wk., m., sab	sh			s		$CaCO_3$ v. finely divided throughout

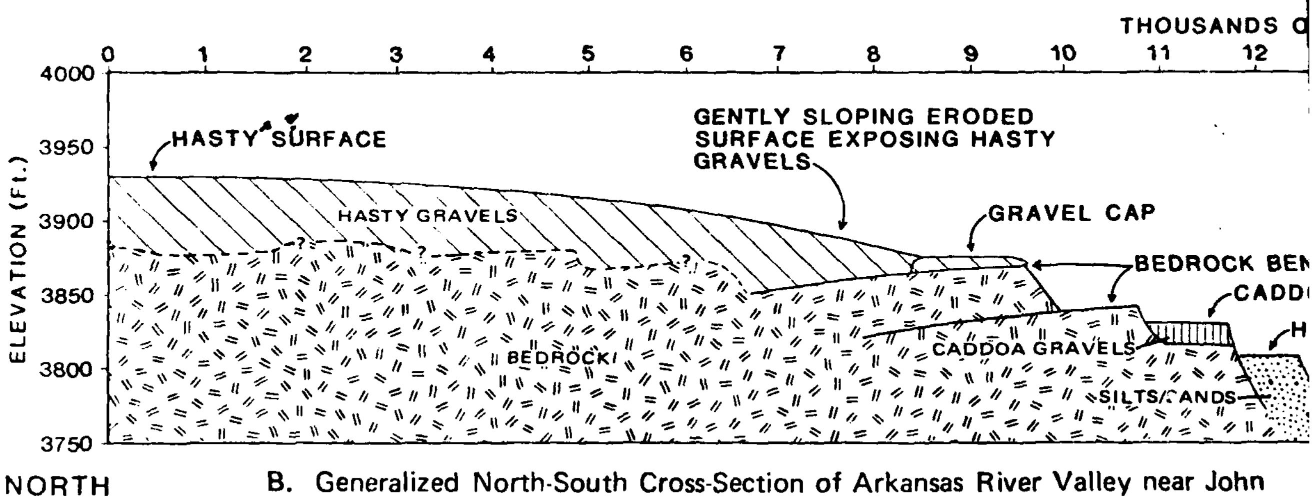
FIGURE

PROFILE AND CROSS SECTION OF

JOHN MARTIN RES

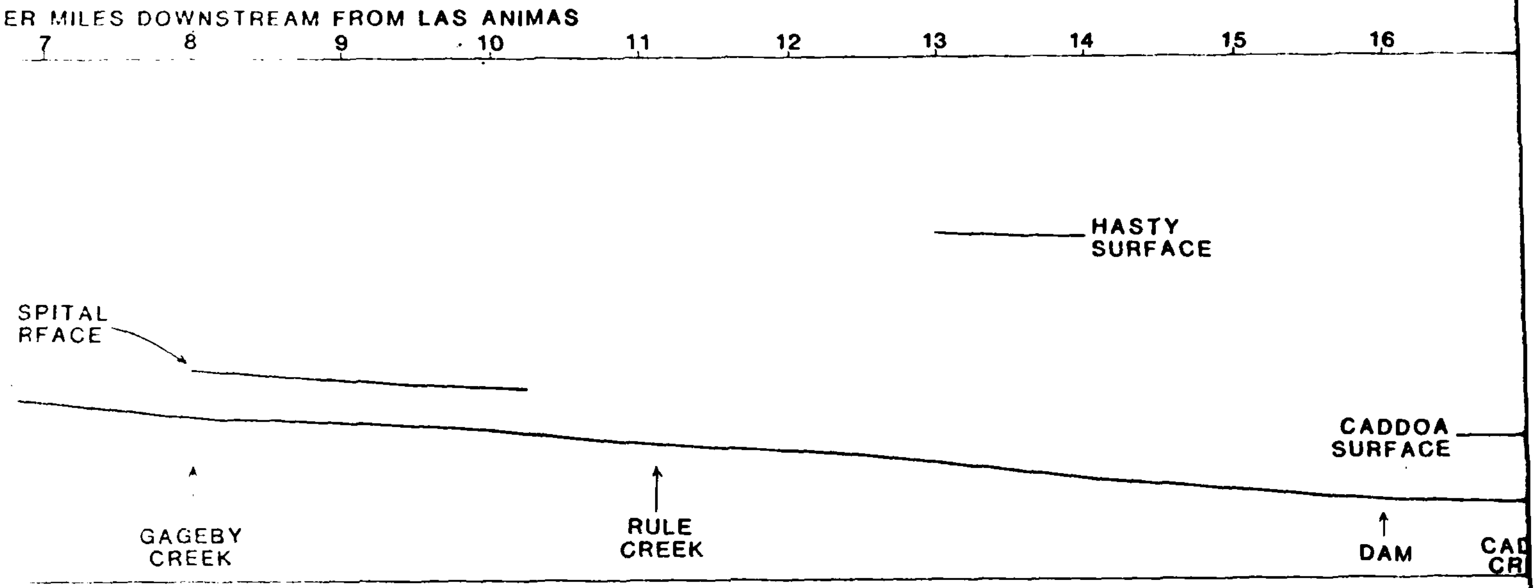


A. Schematic Stream Terrace Profile of Arkansas River from Las Animas to John Martin Dam showing principal alluvial surfaces.

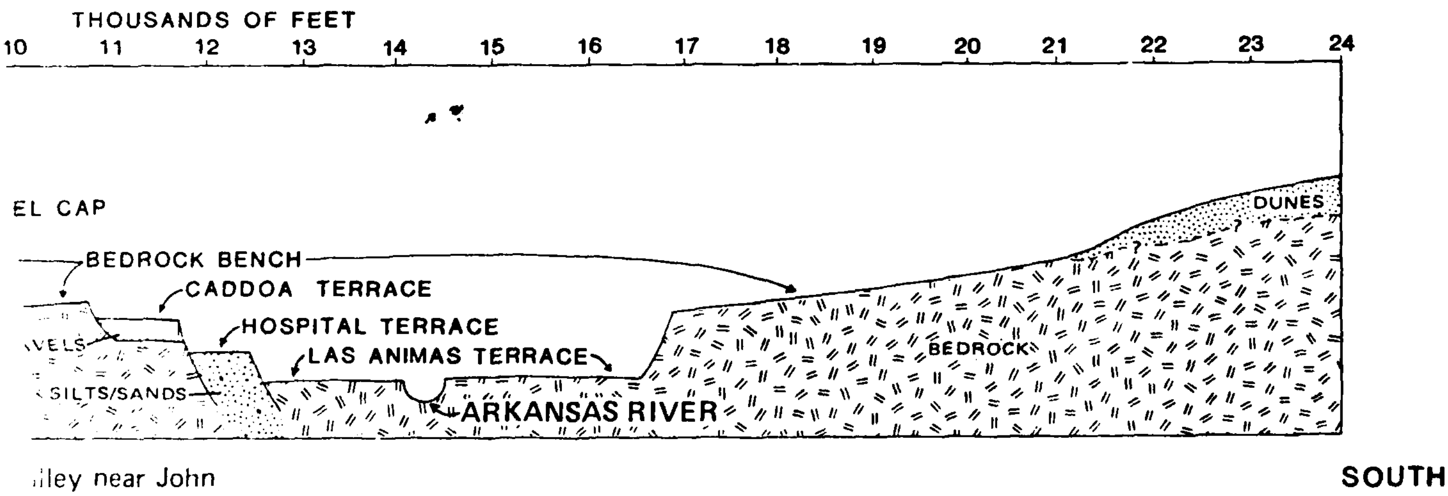


B. Generalized North-South Cross-Section of Arkansas River Valley near John Martin Dam illustrating relationships of bedrock (north dipping Dakota Sandstone), alluvial stratigraphy, and dunes.

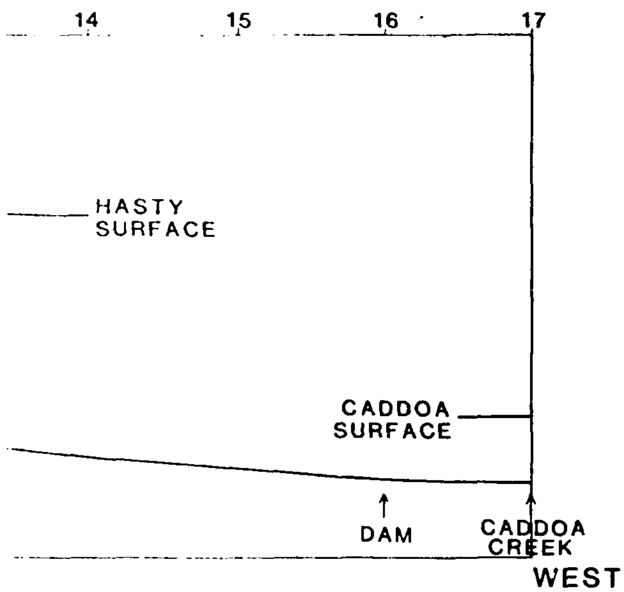
FIGURE 12.6
)SS SECTION OF THE ARKANSAS RIVER VALLEY
-IN MARTIN RESERVOIR PROJECT

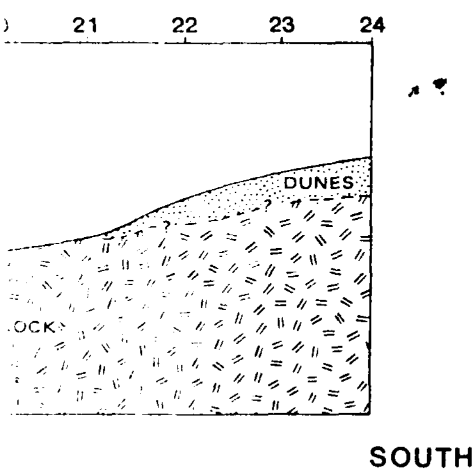


om Las Animas to



ılley near John
ipping Dakota


14
15
16
17
HASTY SURFACE
CADDOA SURFACE
DAM
CADDOA CREEK
WEST


21
22
23
24
DUNES
SOUTH

This includes the surface on which the small community of Caddoa rests. The Caddoa alluvium consist of well-rounded cobbles of quartzite, sandstone, and some igneous rocks, quite similar to the Hasty deposits. The Caddoa gravels can be seen inset against bedrock which is capped by Hasty gravels. In addition to the stratigraphic relationship, the Caddoa gravels can be differentiated from the Hasty deposits by very thin (1 cm) coatings of $CaCO_3$ on the underside of the cobbles. Again these coatings are considered to be part of a Cca soil horizon (Stage I). The upper portion of the soil has apparently been removed. The Caddoa deposits were mapped as Louviers alluvium by Sharps (1976).

12.3.1.3 THE HOSPITAL SURFACE

The Hospital surface is best preserved in the area of the Ft. Lyons Veterans Hosiptal, for which the terrace is named. Between Gageby Creek and the dam only a very few remnants of this deposit were observed. The Hospital surface is at an elevation of 25-35 ft. above the Arkansas. In observed exposures the upper 60 cm to 1 m of the Hospital alluvium consisted of silt loam. Below this was sand over gravelly sand. This textural gradation suggested a fining upward sequence typical of floodplain alluvial deposits. Soil development in the Hospital alluvium is weak (Table 12.3). The B horizon exhibits 10 YR hues. The strongly developed structure is probably the result of the fine-grained nature of the sediments. The soil also exhibited a Cca horizon intermediate between Stage I and II development.

12.3.1.4 THE LAS ANIMAS SURFACE

The Las Animas surface and sediments represent essentially the modern, wide floodplain of the Arkansas River. Because of agricultural activities, heavy vegetation, and water in the reservoir no exposures of the Las Animas sediments were studied.

Upstream from the project area, particularly at Bent's Fort, there appeared to be a terrace intermediate between the Hospital and Las Animas surfaces, at about 10 ft. It was also noted that the Hospital terrace is considerably better preserved upstream and downstream from the project area, being particularly wide upstream with Highway 194 following it for some miles. Additionally, the stream valley in the John Martin Reservoir area is considerably more narrow than it is to the east or west. The reasons for these anomalies are not understood but may be related to the Las Animas arch. This anticline brings the more resistant Dakota Sandstone to the surface in the reservoir area. Upstream and downstream less resistant shales form the valley walls and would tend to allow the river to cut a wider valley. In the project area the Dakota Sandstone would inhibit lateral movement of the Arkansas. Low terraces such as the Hospital surface were probably formed but eventually destroyed as the Arkansas River moved across the valley floor between the constricting bedrock valley walls.

12.3.1.5 AGES OF THE ALLUVIAL DEPOSITS AND SURFACES

The ages of the alluvial deposits and surfaces are difficult to determine without radiometric analyses and more detailed field investigation. However, minimum ages can be estimated based on the degree of soil development in the sediments, particularly the $CaCO_3$ coatings, as well as the texture and distribution of the alluvium.

The time necessary for development of these coatings can vary considerably depending on the amount of airfall $CaCO_3$ and variations in this through time; amount of $CaCO_3$ in the original parent material local rates of evapotranspiration; and permeability of the parent material. Quantification of these factors is beyond the scope of this report. However, the permeability of the gravels is quite high and would inhibit development of calcic horizons. Based on studies

of development of such horizons in other areas, however, minimal ages for the calcic horizon in the project area can be estimated. In the Las Cruces, New Mexico area Gile et al. (1966) date Stage I development in gravelly parent material to the Holocene (less than 10,000 years old) and Stage II formation to the late Pleistocene. In the Lafayette Quadrangle, between Boulder and Denver, Stage II calcic horizons can apparently form in coarse-grained deposits of late Pleistocene (Wisconsin) age. The coarse nature of the deposits and width of the terraces in the project area suggest discharge and competence, possibly during periods of glacial retreat in the Rocky Mountains. All available information then suggests that the Hasty and Caddoa deposits are, at a minimum, of Wisconsin age, perhaps early and late, respectively.

Beveling of the Hasty and Caddoa surface has exposed the carbonate encrusted gravels at the surface indicating that these calcic horizons formed prior to erosion. Furthermore, the Arkansas River probably remained at some level above the base of the gravels for some time after deposition, allowing time for the soil and associated calcic horizon to develop on a stable surface. One cycle of downcutting and deposition may have occurred resulting in emplacement of the Caddoa sediments. Eventually, the Arkansas cut a deeper valley down to the level of the Hospital surface than the Las Animas surface. Once these later periods of degradation commenced, the older higher gravels began to be eroded resulting in the present slope configuration. This suggests that the gravels, particularly of Hasty age may be earlier than Wisconsin age because considerable time would be necessary to form the calcic horizons then degrade the valley prior to formation of the Hospital terrace.

Deposition of the loess on the Hasty surface apparently occurred prior to or in the early stage of erosion of the Hasty terrace since no eroded remnants of loess were found in any area of eroded Hasty gravels and soil development in the loess indicates that the unit has been in place as least as long as the Hospital sediments.

Soil development on the Hospital deposits suggests that the unit is probably no older than latest Wisconsin. The Hospital soil is quite similar in morphology to soils developed on fine-grained material mapped as Broadway alluvium in the Lafayette quadrangle (Machette 1975). Both soils have loamy parent material, 10YR hues in the B horizon and Stage I-II calcic horizons. As discussed earlier, the Broadway surface along the South Platte River is probably about 11,000 years old. The Hospital surface is probably of similar age and the Hospital deposits are probably not appreciably older.

The Las Animas sediments are probably quite young. Evidence from maps and aerial photos indicates that the river has been quite active, meandering across the floodplain rather quickly. It is likely that most of the floodplain sediments have been reworked within the past few hundred years.

12.3.1.6 DUNES

The dunes along the south side of the project area are part of an extensive belt of dunes common along the Arkansas River in the area. A similar belt of dunes is found along the south side of the South Platte. The dunes generally overlie well-rounded cobbles with thick $CaCO_3$ coatings considered to be Hasty gravels. The dune field begins near the floodplain and extends southward for some miles. The sediments commonly are coarse near the river (sands to loamy sands to sandy loams) becoming progressively finer to the south (silts and silt loams) with many areas over one-half to one mile to the south of the river mapped as loess (Sharps 1976). This indicates that the eolian material was probably blown out of the Arkansas River valley. The project area includes dunes with the coarser

textured sediments.

From field and aerial photo examination, two cycles of duning are apparent. The older cycle dunes are large, low, rolling features with crests several thousand feet apart and heights of several hundred feet. They are relatively heavily vegetated. Soils on the older cycle dunes exhibit profiles with weak B horizons (10 YR-7.5 YR hues, little structural development) and Stage I-II calcic horizons (Table 12.4). The B horizon development is sufficient enough, however, to form a ledge where buried by the younger dunes.

The recent dunes occur in local clusters of active dunes overlying the older dunes. These dunes have little vegetation. Soils are weakly developed with thin A horizons over unaltered, stratified dunes deposits.

The older dunes along the Arkansas and South Platte rivers are generally considered to be of early mid-Holocene age (7000-5000 B.P.), perhaps relating to the thermal maximum or Altithermal. However, many of these dunes exhibit A/AC/C soil profiles with 10 YR hues (Muhs and Madole 1980). The older dunes in the project area, then, may be of early Holocene age, or local conditions in the area influenced soil development in sediments otherwise of mid-Holocene age. During the course of research on the southern High Plains of Texas concerning Holocene pedogenesis, the writer has observed soils exhibiting A/B/Cca profiles formed in material of similar texture (loamy sand) no older than 5000 B.P. The younger dunes are presently active. In was not possible to determine when this cycle of duning began.

12.4 SUMMARY AND CONCLUSIONS

From the foregoing, it is apparent that correlations of archeological sites with alluvial deposits and surfaces on the north side of the reservoir are of limited value. The deposits of Hasty and Caddoa age undoubtedly predate known human occupation of the Central Plains. Beveling of the Hasty deposits has probably continued throughout the Holocene but information presently available is insufficient for determining the age erosion of specific exposures of Hasty gravels. The Hospital surface probaby formed over 10,000 years ago and thus could contain archeological material as old as late Paleo-Indian. Archeological remains found on the floodplain (Las Animas surface) are probably quite young, and provenience of any but Historic materials is questionable owing to relatively recent reworking of the sediments by the Arkansas and depositon and erosion resulting from repeated raising and lowering of the reservoir.

The age of the dunes on the south side of the project area is more certain than the alluvial deposits. Any material found in the sediments of the older stablized dunes is at least of mid-Holocene age. Material found on the surface of the older dunes or within the younger dunes would be less than about 5000 years old.

Finally, the results of the geologic investigations in John Martin Reservoir demonstrates the problems in correlating terraces and associated deposits of two major drainages and carrying over stratigraphic terminology from one to another. There was no evidence in the project area that suggested that the older, higher gravels (Hasty deposits) could be subdivided into "Verdos" and "Slocum" equivalents as mapped by Sharps (1976). Furthermore, there was no evidence to indicate that the Hasty gravels were as old as the terminology of Sharps suggests. As mentioned, radiometric dating of Verdos and Slocum alluvium in the Denver area places their age at 600,000 and 160,000 years respectively. The Hasty gravels seem to be considerably younger. Louviers alluivum has been dated to about 100,000 B.P. (Machette 1975). The Caddoa deposits, mapped as Louviers (Sharps

1976) show no evidence of such age. Although the Hospital surface may be of about the same age as the Broadway terrace (ca. 10,000 B.P.), there is no indication that the Hospital sediments are the same age as Broadway alluvium (45,000 years; Machette 1975).

SECTION 13.0
APPENDIX B
GEOLOGY AND PALEONTOLOGY
by Judith Van Couvering

The John Martin Reservoir area lies in the Arkansas River Valley between Las Animas and Hasty, Bent County, Colorado. Because of the agricultural importance of the surface and groundwater in the area much of the geological work has been to provide basic data for hydrogeological studies. Gilbert (1896) and Dart... (1906) were the first to provide comprehensive geological surveys of the Bent County portion of the valley. These early studies, together with the work of Duce (1924), are still the most comprehensive reports in the area, although other stretches of the river and its surroundings have recently been studied in detail (Weist 1965; Voegeli and Hershey 1965). Irwin has mapped Bent County in some detail but this work remains unpublished except as it appears on the 1:250,000 Lamar (Sharps 1976) and La Junta (Scott 1968) sheets. The Lamar sheet provides the best published geological map available for the area at this time. Other geological studies in the area include Clair (1968), Hurr and Moore (1971), and Hammuda (1974).

Paleontological work in the area is limited, although Dane et al. (1937) and Taylor (1974) have studied parts of the area in some detail. In addition, Scott (1970) has used data from this area for his paleoenvironmental analysis of the Cretaceous.

The summary presented here has been taken primarily from the above-mentioned papers. Holliday (this report) has summarized the Pleistocene geology, and this will only be briefly discussed in this paper.

13.1 GEOLOGICAL SETTING

The Arkansas River Valley lies near the southern limit of the Denver Basin and is crossed by the Las Animas arch. These structural features act together to give the rocks a very slight regional dip to the north-northeast of about ½° to 3° (Weist 1965; Voegeli and Hershey 1965; Sharps 1976). The area is underlain by a thick sequence of Phanerozoic rocks, especially those of Mesozoic age. Table 13.1 summarizes this underlying section. Pre-Cretaceous rocks outcrop only in the southern part of Bent County, but most of the Cretaceous rocks outcrop near the study area. However, the only pre-Pleistocene rocks that actually outcrop within the John Martin Reservoir area are the Dakota Sandstone and the Graneros Shale. The area is dominated by Pleistocene and Holocene alluvial and eolian deposits which were deposited on the preexisting rocks by the Arkansas River and its tributaries (Sharps 1969). These, together with eolian sand and slopewash, mantle much of the Bent County area.

13.2 GEOLOGICAL HISTORY

The geological history of the area has primarily been one of downwarping, transgression of the sea, infilling by sedimentary deposits, cessation of downwarping (or upwarping) and erosion. The Paleozoic history is not recorded in the surficial record of Bent County, but from evidence elsewhere, it is known that immediately preceding the Cambrian the area was downwarped and stable shelf sediments accumulated until the Ordovician (Weist 1965; Voegeli and Hershey 1965), the Ordovician shoreline lying to the west near Canon City (Spjeldnaes, 1967). The Silurian is missing almost everywhere in Colorado, but by Devonian times, the sea had returned to the area west of Canon City depositing limestone and shale. Mississippian stable shelf sediments were deposited

TABLE 13.1
FORMATIONS WHICH OUTCROP IN THE JOHN MARTIN RESERVOIR AREA
(WITH BRIEF LITHOLOGIC DESCRIPTIONS)

Alluvium	Silt, sand, and gravel of modern flood plains and reams, dark-yellowish-gray to yellowish-tan, cross-bedded. Unconsolidated (Sharps 1976).
Eolian Sand	Yellowish-brown very fine to medium silty quartz sand; generally more silty toward top (Sharps 1976).
Broadway Alluvium	Gravel, sand and silt...Pebbles have a very thin caliche coating. Unconsolidated (Sharps 1976).
Louviers Alluvium	Gravel and sand containing very little silt...Caliche coating on pebbles is rarely more than ½ mm thick. Unconsolidated (Sharps 1976).
Slocum Alluvium	Cobbly and bouldery gravel containing silty sand... Caliche rind on pebbles and cobbles is 3-12 mm thick (Sharps 1976).
Verdos Alluvium	Cobbly gravel and silty sand...Caliche rind on pebbles and cobbles is 3-12 mm thick (Sharp 1976).
Graneros Shale	Dark grey to black, non-calcareous, fissile clayey shale weathering to clay; with thin beds of bentonite and some calcareous concretions; somewhat fossiliferous including fish scales, invertebrates and microfossils.
Dakota Sandstone	Conspicuous ledge and cliff former on reservoir shoreline and west of dam. Hard, fine, even-grained white to tan quartzitic sandstone; weathers to brown; large joint pattern causes rocks to break into very large blocks; weathered surface often pitted. Upper beds as above; somewhat thinly bedded with ripple mar marks, mud cracks and cross beds. Invertebrate tracks and traces abundant. Fossil wood abundant at some horizons. Middle beds approximately three feet thick; black sandy shale with occasional leaf fossils. Lower beds similar to upper beds but more massive and with fewer sedimentary structures and trace fossils.

elsewhere (Weimer and Land 1972). The tidal flat (sandstone) and marshy (shale) facies have been discussed for the Dakota in the Morrison area by Weimer and Land (1972), who illustrate many of the sedimentary and trace features found here. Macroinvertebrates do occur in the Dakota, but not from these facies.

The Graneros Shale outcrops, as shown by Sharps (1976), on five low ridges on the north side of the reservoir. These outcrops continue to the shoreline in a few places and can there be seen in contact with the Dakota. The Graneros weathers to clay and is thus inconspicuous in the field. It is, when fresh, a dark grey-to-black, noncalcareous, fissile clayey shale with thin beds of bentonite and some calcareous concretions. This formation has produced a sparse, but moderately diverse, macroinvertebrate fauna (Table 13.2) in the area north of the Arkansas River Valley (Dane et al. 1937) and a fairly important suite of microfossils (Table 13.3), primarily Foraminifera, from a site near Pueblo, Colorado, as well as in other areas (Eicher 1965). The microfossils suggest a Cenomanian age for the formation and show that the basin was somewhat restricted during their lifetime, in contrast to the open ocean aspect of the Greenhorn sea which followed.

According to Sharps (1969, 1976) there are four separate Pleistocene-Holocene alluvial terrace deposits in the John Martin Reservoir area. The terms for these terrace units, and the actual existence of the terraces, were determined in the South Platte system by Scott (1963, 1965), who later recognized these units in the Pueblo area (Scott 1964, 1969a,b; Scott et al. 1978). It is possible that the units recognized on this stretch of the Arkansas River by Sharps (1969, 1976) are not equivalent to those near Pueblo, let alone to the units on the South Platte (Holliday, this volume). However, accepting Sharps' analysis (1969, 1976), the oldest alluvial terrace in the area is the Verdos Alluvium which is composed of cobbly gravel and silty sand; the pebbles have a caliche rind between 3 - 12 mm and the basal part can be cemented by caliche (Scott 1976). This alluvium, if the correlation proves to be correct, would be of Kansan or Yarmouth Age, which is equivalent to part of the Irvingtonian Land Mammal Age. The next youngest terrace, the Slocum Alluvium, is similar lithologically but is lower in elevation and more southerly. It would be of Sangaman Age or Rancholabrean Land Mammal Age. The Louviers Alluvium is primarily gravel and sand, has less than 1/2 mm caliche on the pebbles, and is unconsolidated. Scott estimated its age as greater than 12,000 B.P., while Machette (1975) later revised it to 75,000 - 120,000 B.P. based on radiometric dates and pedogenic analysis (Holliday, this volume). The lowest, most southerly, and youngest terrace alluvium is the Broadway Alluvium. It consists primarily of gravel, sand, and silt, and has been dated as ranging between 12,000 - 8500 B.P. by Scott and as 12,000 - 10,000 B.P. by Machette (Holliday, this volume).

All of these terraces could produce vertebrate fossils. However, the only known fossils from the area are a MAMMUTHUS from "Arkansas River gravels", probably from one of the older terraces, judging from its morphology, (Cary Madden, pers. comm.), a CAMELOPS from near La Junta (Peter Robinson, pers. comm.), and a BISON sp. from the Louviers Alluvium near Pueblo (Scott 1969a).

Eolian sand, said by Sharps (1976) to be latest Pleistocene and Holocene, outcrops extensively south of the Arkansas River in the study area. It is described by Sharps (1976) as "yellowish-brown very fine to medium silty quartz sand; generally more silty toward the top." Some of the dunes appear to be stabilized by perennial vegetation, while other parts are covered only with annuals or have been very recently exposed by the lowering of the reservoir level. This sand seems to be totally unconsoli-

TABLE 13.2
FOSSILS KNOWN FROM FORMATIONS WITHIN THE STUDY AREA

Arkansas River Alluvium	MAMMUTHUS sp., CAMELOPS sp., BISON sp. (Louviers Alluvium)
Graneros Shale	Corals, several species
	Pelecypods: LEDA sp., ARCA sp., INOCERAMUS aff. I. BELLVUENSIS, PTERIA sp., PECTEN sp., LUCINA sp., DOSINOPSIS sp.
	Scaphopod: DENTALIUM sp.
	Gastropods: TURITELLA WHITEI, MESOSTOMA OCCIDENTALIS, CINULIA? sp., ACTAEON PROPINQUS
	Cephalopods: MAMMITES sp., METACALYCOCERAS sp., BORRISJAKOCERAS sp., TURRILITES sp.
	Pisces: Scales and disarticulated bones
	Foraminifera: AMMODISCUS PLANUS, REOPHAS PEPPERENSIS, MILIAMMINA ISCHNIA, M. MANITOBENSIS, SPIROLOCAMMINA BOWSHERI, TROCHAMMINOIDES APRICARIUS, HAGLOPHRAGMOIDES GILBERTI, AMMOBACULITES IMPEXUS, AMMOBACULOIDES PLUMMERAE, TEXTULARIA RIOENSIS, PSEUDOBOLIVINA VARIANA, TROCHAMMINA RUTHERFORDI, VERNEUILINA ALAMEDA, VERNEUILINOIDES HECTORI, V. PERPLEXUS, LENTICULINA GAULTINA, HETEROHELIX GLOBULOSA, GLOBIGERINELLOIDES BENTONENSIS, HEDBERGELLA DELRIOENSIS, H. PLANISPIRA, ROTALIPORA cf. R. EVOLUTA.
Dakota Sandstone	Wood and leaf fragments Invertebrate tracks and traces Dinosaur tracks

TABLE 13.3 FOSSILS FROM THE SOUTH PLATTE RIVER ALLUVIAL SEQUENCES (Reproduced from Scott 1963)

Stratigraphic distribution of Quaternary mollusks in formations of the Kassler quadrangle

[Identifications by D. W. Taylor and C. C. Cameron. cf, not certainly identified but resembles the species listed; ?, may be the species listed. Arranged according to Thiele (1931)]

Species	Formation: Pleistocene: Verdos alluvium	Pleistocene: Slocum alluvium	Pleistocene: Louviers alluvium	Pleistocene: Younger loess	Recent: Pre-Piney Creek alluvium	Recent: Eolian sand	Recent: Piney Creek alluvium
Gastropods:							
Carychium exiguum (Say)			X				X
Lymnaea bulimoides Lea			X		X		
caperata Say			X				X
obrussa Say			X				
palustris (Müller)			X				X
parva Lea			X	X		X	X
sp			X	X			X
Gyraulus parvus (Say)			X				X
sp		X	X	X			
cf. *Succinea avara* Say			X	X		X	X
cf. *Succinea grosvenori* Lea	X	X	X		X		
cf. *Succinea*		X	X				X
Cionella lubrica (Müller)			X				
Columella alticola (Ingersoll)			X			X	X
Vertigo gouldi basidens Pilsbry and Vanatta			X				
modesta (Say)			X				
ovata Say			X				
sp						X	
Pupilla blandi Morse		X					
muscorum (Linné)		X	X	X		X	X
sp			X				X
Pupoides albilabris (C. B. Adams)			X		X		X
hordaceus (Gabb)		X			X		
inornatus Vanatta		X	X		X		
Gastrocopta armifera (Say)			X		X		X
cristata (Pilsbry and Vanatta)					X		
holzingeri (Sterki)			X				X
pellucida hordeacella (Pilsbry)		X					
procera (Gould)			X				
lappaniana (C. B. Adams)			X				X
Vallonia cyclophorella Ancey		X	X	X		X	X
gracilicosta Reinhardt		X	X		X	X	X
parvula Sterki			X				X
Punctum minutissimum (Lea)			X				
Helicodiscus singleyanus (Pilsbry)			X				
Hawaiia minuscula (Binney)		X	X		X		X
Retinella electrina (Gould)			X				
Zonitoides arboreus (Say)			X		X		X
Zonitid		X					
Deroceras sp			X				
Euconulus fulvus alaskensis (Pilsbry)			X				X
Oreohelix							?
Pelecypods:							
Pisidium casertanum (Poli)			X				
compressum Prime			X				
obtusale Pfeiffer			cf				
sp							X
Sphaerium sp			X				

Stratigraphic occurrences and ranges of Pleistocene and Recent mammals in the Kassler quadrangle

Species	Formation: Pleistocene: Slocum alluvium	Pleistocene: Louviers alluvium	Pleistocene: Younger loess	Recent: Pre-Piney Creek alluvium	Recent: Piney Creek and post-Piney Creek alluvium
Citellus sp. (ground squirrel)		?			
Cynomys sp. (prairie dog)	×	×			
Thomomys sp. (western pocket gopher)		×			×
Ursus horribilis (grizzly bear)				×	
Mammuthus (Parelephas) columbi (mammoth)		×			
sp		×			
Equus sp. (horse)		×	×		
Camelops sp. (camel)	×	×	×		
Tanupolama sp. (llama)		×			
Odocoileus hemionus (mule deer)		cf		×	×
Bison antiquus (bison)		×			
sp	×	×			
bison					×

and later eroded after the pre-Pennsylvanian uplift of the Las Animas Arch (Hammuda 1974). Although marine Pennsylvanian deposits occur in the area (Hammuda 1974), shoreline and fluviatile Pennsylvanian and Permian sediments occur to the west along the Front Range. These, and the eventual regression of the sea, were by-products of the uplift of the Ancestral Front Range. The Triassic and Jurassic were times of continental deposition and erosion in this area. The Late Jurassic Entrada Sandstone, Ralston Creek and Morrison Formations, which occur in southern Bent County, are also continental deposits. The Morrison Formation was deposited in floodplains which covered much of the Rocky Mountain and western Great Plains regions and has produced a spectacular dinosaur fauna.

The Cretaceous was the time of the last great marine incursions in the area and its record is primarily one of transgression and regression of the great Western Interior Seaway (Kauffman 1977). The early Cretaceous Purgatoire Formation is composed of marine claystones, siltstones, and sandstones (Scott 1968). Near the end of the early Cretaceous, the sea withdrew and the Dakota Sandstone was left as a shoreline deposit, primarily tidal flat and marsh sediments. At the beginning of the late Cretaceous, the sea invaded again, leaving the shales and limestones of the Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Formation and Pierre Shale (Weist 1965; Voegeli and Hershey 1965; Scott 1968; Sharps 1976). All of these formations are fossiliferous (Dane et al. 1937).

The Cenozoic of the area consists of the continental late Miocene Ogallala Formation which occurs in the very southeast of Bent County. This formation may have been somewhat eroded before the beginning of Pleistocene deposition in the area (Sharps, 1969). Several Pleistocene alluvial terrace sequences are found in the area and were formed, according to Sharps (1969) by concurrent changes in base level and local southward migration of the Arkansas River. Sharps (1969) has proposed that the southward migration along this stretch of the river was due to the deposition of larger amounts of material by northern tributaries to the Arkansas River than by southern tributaries, forcing a more southward course in order to skirt the toes of the northern alluvial fans.

13.3 GEOLOGICAL FORMATIONS IN THE STUDY AREA

The only pre-Pleistocene rocks which outcrop in the study are the Dakota Sandstone and the Graneros Shale. Although Sharps (1976) shows the Dakota Sandstone outcropping sparsely around the reservoir margin, the drop in water level which has occurred recently shows that the Dakota outcrops around almost the entire margin of the reservoir area, as well as in the cliffs below the dam. In general, the Dakota is a hard, fine, even-grained, white-to-tan quartzitic sandstone which weathers to brown and is about 100 m thick at maximum. The large joint pattern causes the rocks to break into very large blocks. The weathered surface is, in many cases, pitted. (Duce 1924; Dane et al. 1937; Cobban 1968; Sharps 1976; personal observations). The formation has been divided into three groups locally (Duce 1924). The lower beds, which can be seen on the south side of the lake, are somewhat massive and have fewer sedimentary structures and traces of fossils. In many cases, the surface of these lower beds is heavily iron stained, giving the entire bedding plane a dark brown color. A three foot bed of black sandy shale divides the lower sandstone from the upper sandstone. Fossil leaves can occur here (Dane et al. 1937). The upper beds are similar to the lower except that they are more thinly bedded and have numerous sets of crossbeds. Ripple marks, mudcracks, bioturbated surfaces, and invertebrate tracks and traces are abundant. Fossil wood is abundant at some horizons. Dinosaur tracks have been found in similar facies

dated. If fossils were found in these sands, it would be difficult to separate them from possible extant intrusives, except if they occur out of the range of these modern-day inhabitants.

Slope wash and Piney Creek-post-Piney Creek Alluvium (the latter unseparated on Sharps' map) are the only other two units in the area.

13.4 FOSSIL IMPORTANCE AND POTENTIAL

13.4.1 DAKOTA SANDSTONE

Although few fossils, other than trace fossils and plant fragments can be expected, the extensive exposures of these fossil tidal flat areas, with their broad areas of living floor, should be maintained in as pristine a condition as possible.

13.4.2 GRANEROS SHALE

It is probable that few fossils will be found in these beds due to their poor exposure.

13.4.3 ALLUVIAL TERRACE SEQUENCES

None of the terraces are broadly exposed except the Verdos Alluvium. Any of these sequences could contain fossils which would be of importance both because of the dearth of specimens from the Arkansas River Valley and, in the Broadway and Piney Creek-post-Piney Creek Alluvium, for potential association with artifacts. All outcrops and gravel quarries in these terraces should be investigated for possible fossils.

13.4.4 EOLIAN DEPOSITS

These deposits are broadly exposed in the southern part of the study area. Fossils found here would be potentially important in dating the deposits and in association with artifacts. However, they should be examined with great care because of the ease with which they could be confused with extant, intrusive forms. Blowouts and banks should be investigated for fossils.

13.5 PALEONTOLOGICAL FIELD REPORT

A two-day survey of the John Martin Reservoir site was made in order to evaluate the paleontological potential of the rocks exposed there. While there, I compared the outcrop areas of the pre-Pleistocene rocks, the Dakota Sandstone, and Graneros Shale with Sharps' (1976) geological map, and made a reconaissance of these and the more extensive Pleistocene units in order to evaluate their fossil-producing potential.

The Dakota Sandstone is much more extensive in actual outcrop area than is shown on the map, due to the recent drop in reservoir level. It can now be seen to outcrop around most of the reservoir shore, as well as to the west of the dam. The three-fold division of the Dakota, made early in this century by Duce (1924), seems to hold true in this area. The lower part of the section is exposed best on the south shore of the reservoir, as is the middle section. The upper part is exposed well on the north shore. Here the broad expanses of bedding planes show the superb preservation of tidal mud flat floors. These should be preserved, if possible. Various invertebrate tracks, ripple marks, mud cracks and plant fragments are beautifully exposed.

Although the Graneros Shale has a fairly extensive outcrop area on the north shore, as is shown on Sharps' map, it is difficult to see because it is mantled with Pleistocene alluvial pebbles and cobbles. In order to observe it on the low ridges which it underlies, one must dig into the side of the hill or roadcut. Fairly fresh sections do appear above the Dakota, however,

in places on the north shore of the reservoir. I do not expect that any worthwhile fossils or fossil assemblages will be found here.

Of the several alluvial sequences which occur in the area, only the Verdos Alluvium is widespread. All of these alluvial sequences have produced fossils elsewhere on the plains (Table 13.3) and should, thus, be investigated wherever they outcrop or have been quarried. Both fossil mollusks and vertebrates could be found. I did not find any in my brief field survey, but the archeological team could search for fossils in the course of their artifact survey.

The eolian sequence on the south side of the lake is unconsolidated, although somewhat stablilized in areas. Any bones or shells found in these sequences should be carefully studied in order to separate them from forms living in the area today. Eolian sands elsewhere on the plains have produced fossils.

Any fossils found in the Pleistocene and Holocene sequences could be of great importance due to the dearth of fossils from this area.

SECTION 14.0
APPENDIX C
COMPUTER CODED DATA FILE FOR 99 PREHISTORIC SITES
by Frank W. Eddy

The following table of data (Table 14.1) lists the 99 prehistoric sites on which computer analyses were run searching for both intrasite and intersite patterning. Figure 4.6 provides the necessary four-card format to interpret the data file to include: coding column, variable number (where appropriate), entry, and level of measurement (nominal, ordinal, or interval). Note that Card 1 (Card 1, Col. 11) is repeated many times depending upon the number of field-recorded artifacts which were subjected to intrasite analysis. For each site (JM No.), the first Card 1 carries the information for Variable 7 (VAR7) and Columns 35 through 56, data which is employed for programming control. Otherwise, Card 1 is terminated with Column 33. Card 2 contains environmental variables whereas Cards 3 and 4 have site variables (Figure 4.6). Note that Variable 43 was inadvertently skipped when designing the recording system. The size of the data file, consisting of 99 sites, differs from the full number of recorded prehistoric sites (111 components) in that rock art and sites with a very few artifacts were deleted as inappropriate for the quantitative study of settlement and variability.

TABLE 14.1
COMPUTER LIST OF 99 PREHISTORIC SITES

```
 000000000000

 0000000000000

 0000000000000
JM005 001 1  1  0  1  310   50 00  52 000 0000085500 0 1
JM005 002 1  2  0  1  410   54 00
JM005 003 1  1  0  2 3550   92 00
JM005 004 1  4 10  0 3530  156 00
JM005 005 1  7  0  1   20  186 00
JM005 006 1  2 14  1    0  232 00
JM005 007 1  2  0  1    0  228 00
JM005 008 1  7  4  2 3540  246 00
JM005 009 1  3  0  1   70  256 00
JM005 010 1  3  0  1  310  232 00
JM005 011 1  7  1  1  140  394 00
JM005 012 1  4 14  3  140  510 00
JM005 013 1  1 14  1 3530  535 00
JM005 014 1  1 14  1  260  560 00
JM005 015 1  7  0  2  270  725 00
JM005 016 1  4  0 10  210  895 00
JM005 017 1  7  0  5  240 1070 00
JM005 018 1  3 14  6  300  126 00
JM005 019 1  1  0  1  720  116 00
JM005 020 1  7  0  1  840  143 00
JM005 021 1  2  0  1  950  254 00
JM005 022 1  4 14  1 1050  259 00
JM005 023 1  3 14  1 1240  199 00
JM005 024 1  2  0 11  800  316 00
JM005 025 1  7  0  1  790  321 00
JM005 026 1  3  0  3  780  318 00
JM005 027 1  2 14  1 1830  179 00
JM005 028 1  1  0  2 1840  182 00
JM005 029 1  2  0  3 1820  180 00
JM005 030 1  3 14  1 1810  417 00
JM005 031 1  2 14  1 1840  408 00
JM005 032 1  0  0  2 1860  404 02
JM005 033 1  7  0  6 1930  395 00
JM005 034 1  3 14  3 1940  390 00
JM005 035 1  2 14  1 1940  427 00
JM005 036 1  2 14  1 1930  423 00
JM005 037 1  3  0  0 1930  420 00
JM005 038 1  2  0  4 1970  443 00
JM005 039 1  3 14  1 1960  427 00
JM005 040 1  2  0  3 1960  435 00
JM005 041 1  3  0  1 1980  448 00
JM005 042 1  2  0  1 2060  390 00
JM005 043 1  2  0  1 2090  382 00
JM005 044 1  7  3  6 2050  327 00
JM005 045 1  7  1  1 2190  237 00
JM005 046 1  1  0  1 1910  438 00
JM005 047 1  3 14  1 1890  490 00
JM005 048 1  2  0  2 1860  466 00
JM005 049 1  2 14  3 1940  854 00
JM005 050 1  7  0  5 1920  856 00
JM005 051 1  3 14  5 1940  985 00
JM005 052 1  7  0  1 1960 1070 00
JM005 064 2 015 025 2700 11798 02058 0075 12195 00335 00340 986 2 0800 02133030
JM005     3 678700 421644 00     100000    9 0052000 0086 0022 .04    0 .02 .02    0
JM005     4    0 .33    0    0    0 .15 .10 .19 .10    0    0 .02 .02    0    0    0    0
JM007 001 1  1 14  1 1470  212 00  29 000 0000065000 0 1
JM007 002 1  1 14  1 1490  221 00
```

Table 14.1 - continued

```
JM007 003 1  2 10  1 1480   222 00
JM007 004 1  3 14  1 1480   228 00
JM007 005 1  3 14  1 1410   349 00
JM007 006 1  3 14  1 1430   360 00
JM007 007 1  7  1  2 1440   366 00
JM007 008 1  7  1  1 1420   499 00
JM007 009 1  1 14  1 1360   466 00
JM007 010 1  2 14  1 1220   477 00
JM007 011 1  3 10  2 1210   470 00
JM007 012 1  3 14  3 1180   440 00
JM007 013 1  2  0  1 1150   436 00
JM007 014 1  1 14  1 1200   313 00
JM007 015 1  4 10  1 1020   221 00
JM007 016 1  3 10  1  930   182 00
JM007 017 1  7  1  2  890   260 00
JM007 018 1  1 14  1  670   162 00
JM007 019 1  3 14  1  660   168 00
JM007 020 1  3  0  1  610   148 00
JM007 021 1  1  0  1  580   142 00
JM007 022 1  1 14  3  560   154 00
JM007 023 1  2 14  3  540   132 00
JM007 024 1  3 14  3  190   162 00
JM007 025 1  7  0  1   40   207 00
JM007 026 1  7  3  3 3310   420 00
JM007 027 1  3 14  3 3310   420 00
JM007 028 1  2 13  1 2950   398 00
JM007 029 1  1 13  3 3030   602 00
JM007 064 2 015 050 1550 11753 02058 0256 02058 00256 00780 999 1 0800 02133030
JM007     3 678460 421550 00    060000   8 0048333 0029 0021 .10   0 .10 .14   0
JM007     4   0 .52   0    0    0 .03 .03 .03 .03   0    0    0    0    0    0    0
JM008 001 1  4 12  1 1190   501 00  59 000 0000437500 0 9
JM008 002 1  7  0  1 1230   402 00
JM008 003 1  4 14  1 1110   235 00
JM008 004 1  7  1  2 1030   164 00
JM008 005 1  2 14  1 1370   113 00
JM008 006 1  2 14  1 1320   101 00
JM008 007 1  1 14  1 1350   433 00
JM008 008 1  1 14  1 1500   362 00
JM008 009 1  7  1  1 1780   174 00
JM008 010 1  7  0  1 1920   183 00
JM008 011 1  1 14  1 2320   147 00
JM008 012 1  3 12 12 2590   275 00
JM008 013 1  4 13  0 2750   222 00
JM008 014 1  4 13  1 2700   350 00
JM008 015 1  4 13  1 2730   466 00
JM008 016 1  3 13  1 2780   605 00
JM008 017 1  1  0  1 2820   476 00
JM008 018 1  4 14 16 2970   408 00
JM008 019 1  4 13  1 2980   409 00
JM008 020 1  4 13  3 2960   362 00
JM008 021 1  2  0  1 2950   250 00
JM008 022 1  4 12  1 3020   250 00
JM008 023 1  2  0  1 3060   250 00
JM008 024 1  4 14  1 3090   292 00
JM008 025 1  1  0  1 3420   267 00
JM008 026 1  1 14  1 3430   423 00
JM008 027 1  4 13  1 3430   525 00
JM008 028 1  7  0  1 3420   542 00
JM008 029 1  7  0  1   20   238 00
JM008 030 1  7  0  3 1050    60 00
JM008 031 1  7  3  1 2320   267 00
JM008 032 1  3  0  1 2160   282 00
```

Table 14.1 - continued

```
 2320  267 00
JM008 032 1  3  0  1 2160  282 00
JM008 033 1  3 14  5 2620  540 00
JM008 034 1  2  0  2 2640  540 07
JM008 035 1  7  0  3 2640  540 07
JM008 036 1  7  0  3 2640  540 07
JM008 037 1  7  0 13 2640  540 07
JM008 038 1  7  0  3 2640  540 07
JM008 039 1  2  0  3 2640  540 07
JM008 040 1  3  0  2 2640  540 07
JM008 041 1  7  0  3 2640  540 07
JM008 042 1  4 14  3 2640  540 07
JM008 043 1  7  0  1 3130  439 00
JM008 044 1  4 10  1 3130  439 00
JM008 045 1  2  0  3 3140  456 00
JM008 046 1  3 14  5 3350  816 00
JM008 047 1  4 10  2 3380  742 00
JM008 048 1  7  0 12   90  623 00
JM008 049 1  7  1 14 1320  324 00
JM008 050 1  3 14  1 2470  222 00
JM008 051 1  1 14  1 2620  232 00
JM008 052 1  7  4  3 2650  248 00
JM008 053 1  7  1  1 2770  324 00
JM008 054 1  2  0  5 2530  251 00
JM008 055 1  3  0  1 3000  440 00
JM008 056 1  3 14 16 3000  440 00
JM008 057 1  1  0  1 3060  581 00
JM008 058 1  4 14  3 3330  250 00
JM008 059 1  3 14  5 3540  591 00
 3070 1010 3017 1510 0000 0000 030 050 000 049 059 000
JM008 064 2 015 050 1900 11753 03659 0274 03659 00274 00600 999 1 0800 02133030
JM008     3 678340 421556 00    043750  10 0134857 0048 0023 .07   0 .14 .03   0
JM008     4 .05 .29   0   0   0 .20 .05 .10 .05   0   0   0 .02   0   0   0   0
JM009 001 1  1  0  3   30   41 00  45 000 0000092000 0 1
JM009 002 1  7  1  1 3520  245 00
JM009 003 1  7  0  1 3470  330 00
JM009 004 1  7  0  1   70  320 00
JM009 005 1  2 14  1  110  315 00
JM009 006 1  3 14  1  130  320 00
JM009 007 1  7  1  1  170  375 00
JM009 008 1  7  4  1  170  370 00
JM009 009 1  2 14  1  230  320 00
JM009 010 1  7  4  1  360  360 00
JM009 011 1  1 14  1  460  135 00
JM009 012 1  3 14  1  490  148 00
JM009 013 1  7  1  1  680  301 00
JM009 014 1  2 14  1  710  309 00
JM009 015 1  7  0  1  650  406 00
JM009 016 1  2 14  3  660  399 00
JM009 017 1  2 14  1  880  336 00
JM009 018 1  7  0  1  885  346 00
JM009 019 1  7  4  1  890  333 00
JM009 020 1  3  0  1  890  345 00
JM009 021 1  2 14  3 1100  197 00
JM009 022 1  1  0  3 1140  211 00
JM009 023 1  7  0  3 1150  278 00
JM009 024 1  7  0  3 1120  335 00
JM009 025 1  1 14  1 1160  420 00
JM009 026 1  7  1  1 1280  455 00
JM009 027 1  7  4  1 1300  456 00
JM009 028 1  2 14  1 1290  465 00
JM009 029 1  3 13  1 1290  485 00
```

Table 14.1 - continued

```
JM009 030 1   1 14   1 1390   535 00
JM009 031 1   7  0   1 1450   593 00
JM009 032 1   2 14   1 1410   378 00
JM009 033 1   7  0   2 1430   375 00
JM009 034 1   1 14   1 1520   243 00
JM009 035 1   1 14   2 2510   426 00
JM009 036 1   1 14   1 2500   438 00
JM009 037 1   4 12   1 2830   443 00
JM009 038 1   1  0   3 2780   501 00
JM009 039 1   3  0   1 2710   542 00
JM009 040 1   1 14   1 2860   487 00
JM009 041 1   2  0   1 2900   463 00
JM009 042 1   7  0   3 2880   415 00
JM009 043 1   3  0   1 2780   820 00
JM009 044 1   7  0   1 2990   454 00
JM009 045 1   7  4   1 3020   600 00
JM009 064 2 015 050 1900 11769 03250 0016 00610 00290 00520 999 1 0800 02133030
JM009     3 678480 421579 00     182000    8 0024725 0067 0024 .09    0 .02    0    0
JM009     4 .02 .38    0    0    0 .22 .07 .02 .07    0    0    0 .11    0    0    0    0
JM010 001 1   3 14   1  610    65 00  63 000 0000095000 0 1
JM010 002 1   7  0   2  850    98 00
JM010 003 1   3  0   1  630   164 00
JM010 004 1   2 13   3  560   173 00
JM010 005 1   1 14   1  660   203 00
JM010 006 1   7  1   1  610   339 00
JM010 007 1   1 14   1  790   205 00
JM010 008 1   3 14   1  810   196 00
JM010 009 1   3 14   1  850   199 00
JM010 010 1   7  0   1 1100   258 00
JM010 011 1   3  0   1 1100   258 00
JM010 012 1   7  4   1 1100   258 00
JM010 013 1   7  1   1 1115   257 00
JM010 014 1   2 14   1 1115   257 00
JM010 015 1   1 14   1 1120   248 00
JM010 016 1   1 13   1 1130   254 00
JM010 017 1   2 14   1 1105   125 00
JM010 018 1   7  0   3 1095   125 00
JM010 019 1   2 14   2 1095   125 00
JM010 020 1   1 14   1 1100   117 00
JM010 021 1   2 14   1 1295   271 00
JM010 022 1   7  0   1 1385   274 00
JM010 023 1   3 14   1 1790    58 00
JM010 024 1   3 14   1 1965   107 00
JM010 025 1   3 14   2 1890   137 00
JM010 026 1   3 14   2 1860   358 00
JM010 027 1   7  1   1 1845   438 00
JM010 028 1   4 12   1 1850   483 00
JM010 029 1   1 16   1 1745   568 00
JM010 030 1   3 14   1 1905   631 00
JM010 031 1   3 14   1 2100  1160 00
JM010 032 1   1 14   1 2200   938 00
JM010 033 1   1 14   3 2290   554 00
JM010 034 1   2 14   3 2360   624 00
JM010 035 1   4 12   1 2705   192 00
JM010 036 1   1 13   1 2830   294 00
JM010 037 1   2 14   1 2835   294 00
JM010 038 1   1 14   1 2815   320 00
JM010 039 1   4 13   2 2830   318 00
JM010 040 1   2 14   1 2820   358 00
JM010 041 1   1 14   1 2820   358 00
JM010 042 1   3 14   5 2830   382 00
JM010 043 1   3 14   1 2945   323 00
```

Table 14.1 - continued

```
JM010 044 1  3 16  1 2940  293 00
JM010 045 1  7  4  1 2955  223 00
JM010 046 1  1 14  1 2930  196 00
JM010 047 1  7  0  3 2810  188 00
JM010 048 1  3 14  1 3110  121 00
JM010 049 1  1 14  1 3200  166 00
JM010 050 1  3 14  1 3240  158 00
JM010 051 1  2 14  1 3150  222 00
JM010 052 1  7  1  1 3110  278 00
JM010 053 1  2 14  5 2975  748 00
JM010 054 1  7  1  1 3500  294 00
JM010 055 1  1 13  1 3505  378 00
JM010 056 1  1 14  1 3590  307 00
JM010 057 1  7  4  1   20  330 00
JM010 058 1  7  4  1  325  318 00
JM010 059 1  7  4  1  335  332 00
JM010 060 1  1 13  1  360  331 00
JM010 061 1  7  0  1  370  348 00
JM010 062 1  7  4  1  370  287 00
JM010 063 1  7  4  1  420  244 00
JM010 100 2 015 050 0900 11769 00671 0031 08659 00306 00320 983 2 0800 02133030
JM010     3 678400 421605 00    150000    7 0042000 0086 0025 .08   0 .10   0   0
JM010     4 .03 .52   0   0   0 .10   0   0 .03   0   0   0 .11   0   0   0   0
JM011 001 1  2 14  1  960   18 00  36 000 0000056250 0 1
JM011 002 1  1 14  1  880   70 00
JM011 003 1  7  0  1  710  234 00
JM011 004 1  1 14  1  700  230 00
JM011 005 1  7  1  1  750  274 00
JM011 006 1  3  0  1  860  295 00
JM011 007 1  1 14  1  850  302 00
JM011 008 1  2 14  1  840  337 00
JM011 009 1  7  4  1  720  422 00
JM011 010 1  4 13  3  590  264 00
JM011 011 1  7  0  2  460  310 00
JM011 012 1  3 14  1  450  225 00
JM011 013 1  7  4  3  270   65 00
JM011 014 1  1 14  1  150  232 00
JM011 015 1  4 10  2  180  352 00
JM011 016 1  0 12  1 3550  352 00
JM011 017 1  0 12  2 3540  344 00
JM011 018 1  2 14  1 3510  328 00
JM011 019 1  2 14  1 3560  253 00
JM011 020 1  2 14  1 3430  192 00
JM011 021 1  3  0  1 3440  142 00
JM011 022 1  3  0  2   30   90 00
JM011 023 1  4 10  3 2900  139 00
JM011 024 1  2 14  1 1940  355 00
JM011 025 1  7  0  2 2080  421 00
JM011 026 1  7  0  3 1880  266 00
JM011 027 1  2 15  6 1780  297 00
JM011 028 1  7  0  1 1840  226 00
JM011 029 1  1 14  1 1810  141 00
JM011 030 1  7  4 12 1350   99 00
JM011 031 1  2 14  1 1470  261 00
JM011 032 1  7  3  2 1470  256 00
JM011 033 1  7  4  1 1210  281 00
JM011 034 1  7  4  7 1060  160 00
JM011 035 1  2 14  1  910  260 00
JM011 036 1  3  0  1  760  570 00
JM011 064 2 015 050 1200 11753 00457 0009 10137 00290 00200 964 2 0800 02133030
JM011     3 678400 421613 00    056250    8 0064000 0076 0025 .03   0 .06 .06   0
JM011     4   0 .39 .03   0   0 .14   0   0 .11   0   0   0 .14   0   0   0   0
```

Table 14.1 - continued

JM012	001	1	3	14	2	575	18	00	89	000	0000107100	0	1
JM012	002	1	7	4	0	520	252	00					
JM012	003	1	7	0	1	190	325	00					
JM012	004	1	3	0	1	150	287	00					
JM012	005	1	7	4	1	110	337	00					
JM012	006	1	2	0	2	150	150	00					
JM012	007	1	1	14	1	3530	104	00					
JM012	008	1	7	4	3	3530	104	00					
JM012	009	1	7	4	8	3240	108	00					
JM012	010	1	4	10	2	3230	205	00					
JM012	011	1	4	13	11	3230	205	00					
JM012	012	1	7	4	11	3220	204	00					
JM012	013	1	1	14	11	3220	204	00					
JM012	014	1	2	14	11	3220	204	00					
JM012	015	1	7	3	8	3400	310	00					
JM012	016	1	1	14	1	3290	427	00					
JM012	017	1	3	14	2	3260	205	00					
JM012	018	1	7	4	3	3260	205	00					
JM012	019	1	1	14	2	3220	430	00					
JM012	020	1	2	14	1	3210	665	00					
JM012	021	1	1	14	2	3160	415	00					
JM012	022	1	3	14	7	3140	352	00					
JM012	023	1	3	13	2	3140	352	00					
JM012	024	1	7	0	3	3140	243	00					
JM012	025	1	3	0	3	3020	206	00					
JM012	026	1	3	14	11	3030	589	00					
JM012	027	1	7	3	11	2960	502	00					
JM012	028	1	7	3	3	2920	458	00					
JM012	029	1	1	14	1	2920	443	00					
JM012	030	1	2	14	3	2890	638	00					
JM012	031	1	2	14	2	2850	416	00					
JM012	032	1	2	14	5	2840	422	00					
JM012	033	1	7	0	8	2860	299	00					
JM012	034	1	1	14	1	2840	246	00					
JM012	035	1	3	14	3	2930	208	00					
JM012	036	1	2	13	3	2980	225	00					
JM012	037	1	1	14	2	2880	104	00					
JM012	038	1	1	14	1	2850	109	00					
JM012	039	1	3	15	1	2740	400	00					
JM012	040	1	3	14	3	2420	452	00					
JM012	041	1	1	14	1	2400	298	00					
JM012	042	1	3	0	1	2410	288	00					
JM012	043	1	7	0	2	2480	132	00					
JM012	044	1	1	14	2	2510	128	00					
JM012	045	1	1	14	1	2450	141	00					
JM012	046	1	1	14	1	2440	136	00					
JM012	047	1	1	14	1	2450	115	00					
JM012	048	1	1	14	1	2440	110	00					
JM012	049	1	7	0	1	2410	91	00					
JM012	050	1	7	1	0	2380	83	00					
JM012	051	1	7	4	2	2480	67	00					
JM012	052	1	1	14	1	2360	149	00					
JM012	053	1	7	3	3	2310	158	00					
JM012	054	1	7	0	8	2420	208	00					
JM012	055	1	2	13	1	2310	295	00					
JM012	056	1	2	13	1	2200	219	00					
JM012	057	1	3	14	1	2140	193	00					
JM012	058	1	1	14	1	1950	391	00					
JM012	059	1	2	14	1	1950	391	00					
JM012	060	1	2	0	2	1940	394	00					
JM012	061	1	2	13	2	1950	420	00					
JM012	062	1	1	0	2	1860	297	00					

Table 14.1 - continued

```
JM012 063 1   1  0  7 1840   273 00
JM012 064 1   3 14 11 1830   278 00
JM012 065 1   1 14  1 1830   278 00
JM012 066 1   7  4  1 1810   142 00
JM012 067 1   1 14  7 1730   128 00
JM012 068 1   7  4  1 1650   254 00
JM012 069 1   1 14  1 1470   473 00
JM012 070 1   1 14  2 1470   473 00
JM012 071 1   7  0  2 1470   464 00
JM012 072 1   1 16  2 1470   462 00
JM012 073 1   7  4  1 1300   243 00
JM012 074 1   7  2  2 1300   246 00
JM012 075 1   2 14  1 1170   268 00
JM012 076 1   4 12  1 1120   382 00
JM012 077 1   7  0  3 1110   378 00
JM012 078 1   7  3  1 1060   449 00
JM012 079 1   4 10  2 1060   499 00
JM012 080 1   3 14  8 1050   515 00
JM012 081 1   1  0  2 1050   515 00
JM012 082 1   3  0  2 1050   515 00
JM012 083 1   1 14  2 1050   515 00
JM012 084 1   1 15  1 1050   584 00
JM012 085 1   2 14  2  990   500 00
JM012 086 1   7  4  1  990   608 00
JM012 087 1   3 14  1  920   506 00
JM012 088 1   1 14  1  910   493 00
JM012 089 1   3 14  8  940   149 00
JM012 100 2 015 050 1900 11784 00305 0061 11128 00321 00160 953 2 0800 02133030
JM012     3 678300 421625 00    107100  13 0008309 0105 0025 .01 .01 .12 .02   0
JM012     4 .01 .47 .02   0   0 .09 .03 .02 .04   0   0   0 .12   0   0   0   0
JM013 001 1   3 15  6  560    71 00  64 000 0000069000 0 9
JM013 002 1   3 14  3  610    77 00
JM013 003 1   2 14  1  640   141 00
JM013 004 1   7  4  5  720   139 00
JM013 005 1   7  4  6  730   134 00
JM013 006 1   1  0  2  740    84 00
JM013 007 1   1 14  1  750   195 00
JM013 008 1   7  4  2  800   181 00
JM013 009 1   3 14  6  830   180 00
JM013 010 1   7  4  1  840   171 00
JM013 011 1   2 14  1  820   161 00
JM013 012 1   2 14  1  820   164 00
JM013 013 1   3 14  1  840   166 00
JM013 014 1   2 14  2  860   190 00
JM013 015 1   2 14  1  890   164 00
JM013 016 1   7  4 11  910   171 00
JM013 017 1   2 14  1  930   233 00
JM013 018 1   3 15  1  900   362 00
JM013 019 1   1 14  2 1000   237 00
JM013 020 1   3 14  1 1010   210 00
JM013 021 1   2 14  3  320   227 00
JM013 022 1   2  0  1  450   210 00
JM013 023 1   2  0  6  690   211 00
JM013 024 1   7  3  3  110    87 00
JM013 025 1   7  4  6 1190    83 00
JM013 026 1   7  4  6 1190   107 00
JM013 027 1   7  4  6 1230   108 00
JM013 028 1   7  0  3 1290   114 00
JM013 029 1   7  4  3 1230   179 00
JM013 030 1   7  4  3 1240   232 00
JM013 031 1   7  4  6 1210   448 00
JM013 032 1   2 14  1 2280    69 00
```

Table 14.1 - continued

```
JM013 033 1  2 15  3 2270  133 00
JM013 034 1  2 15  3 2380  215 00
JM013 035 1  2 14  1 2390  205 00
JM013 036 1  7  0  3 2370  302 00
JM013 037 1  3  0  3 2380  319 00
JM013 038 1  7  0  8 2380  319 00
JM013 039 1  1 14  1 2480  268 00
JM013 040 1  7  0  1 2490  370 00
JM013 041 1  7  4  3 2520  265 00
JM013 042 1  3 14  2 2590  337 00
JM013 043 1  2 14  2 2590  320 00
JM013 044 1  3 14 11 2690  272 00
JM013 045 1  1 14  2 2900  355 00
JM013 046 1  2 14  1 3040  415 00
JM013 047 1  3 15  1 3070  517 00
JM013 048 1  7  0  2 3060  524 00
JM013 049 1  2 14  1 3170  456 00
JM013 050 1  2 15  6 3140  309 00
JM013  51 1  4 12  1 3140  142 00
JM013 052 1  7  0  3 3070  318 00
JM013 053 1  7  0  2 2860  146 00
JM013 054 1  1 14  1 3470  219 00
JM013 055 1  1 13  1 3310  169 00
JM013 056 1  7  4  1 3060  218 00
JM013 057 1  7  0  1 2960  247 00
JM013 058 1  7  4  6 2960  259 00
JM013 059 1  7  3  2 2890  250 00
JM013 060 1  2 14  1 2820  214 00
JM013 061 1  3 14  3 2740  286 00
JM013 062 1  7  0  3 2720  270 00
JM013 063 1  4 10  5 2680  289 00
JM013 064 1  7  4  6 2640  104 00
 2730 0500 0000 0000 0000 0000 054 000 000 064 000 000
JM013 100 2 015 050 0700 11799 01524 0092 12500 00336 00260 917 2 0800 02133030
JM013     3 678340 421644 00    069000  10 0009275 0086 0025   0   0 .05 .02   0
JM013     4 .02 .39 .09   0   0 .14 .02 .03 .02   0   0   0 .23   0   0   0   0
JM014 001 1  7  1  2  770   25 00  18 000 0000019250 0 1
JM014 002 1  7  3  3  510   32 00
JM014 003 1  1 14  6  590  109 00
JM014 004 1  7  4  1  580  133 00
JM014 005 1  1 14  7  650  144 00
JM014 006 1  1 14  1  650  144 00
JM014 007 1  1 14  2 1240  159 00
JM014 008 1  1 13  1 1230  151 00
JM014 009 1  1 14  1 1250  145 00
JM014 010 1  1 13  2 1430   83 00
JM014 011 1  7  4  3 1490   86 00
JM014 012 1  7  1  1 1540   93 00
JM014 013 1  1 14  1 1520   72 00
JM014 014 1  2 14  3 1620  152 00
JM014 015 1  7  4  6 1680  162 00
JM014 016 1  7  0  3 2440  198 00
JM014 017 1  2 14  3 3350  379 00
JM014 018 1  1 14  1 3400  398 00
JM014 064 2 020 050 0800 11845 00838 0031 14253 00366 00300 850 2 0800 02133030
JM014     3 678300 421656 00    019250   5 0093506 0067 0025 .11   0 .17   0   0
JM014     4   0 .50   0   0   0 .06   0   0   0   0   0   0 .17   0   0   0   0
JM016 001 1  7  1  1 1580  314 00  93 000 0000250000 0 9
JM016 002 1  1  0  1 1610  326 00
JM016 003 1  7  4  1 1660  247 00
JM016 004 1  2 14  2 2100  316 00
JM016 005 1  1 14  1 2140  330 00
```

Table 14.1 - continued

JM016	006	1	2	14	1	2170	292	00
JM016	007	1	7	4	2	2190	362	00
JM016	008	1	7	0	3	2190	362	00
JM016	009	1	1	14	1	2270	416	00
JM016	010	1	1	0	1	2360	455	00
JM016	011	1	7	1	2	2380	462	00
JM016	012	1	7	0	2	2370	501	00
JM016	013	1	2	0	2	2110	251	00
JM016	014	1	2	0	2	2170	201	00
JM016	015	1	7	4	1	2240	260	00
JM016	016	1	7	1	1	2480	190	00
JM016	017	1	7	0	5	2320	116	00
JM016	018	1	7	1	1	2330	119	00
JM016	019	1	2	0	2	2820	254	00
JM016	020	1	7	0	5	3090	88	00
JM016	021	1	2	0	5	3090	88	00
JM016	022	1	4	10	1	3490	415	00
JM016	023	1	2	14	1	3510	445	00
JM016	024	1	7	0	3	3530	472	00
JM016	025	1	7	4	3	3560	471	00
JM016	026	1	2	14	1	3460	880	00
JM016	027	1	1	14	1	90	746	00
JM016	028	1	4	10	1	330	384	00
JM016	029	1	2	0	1	340	380	00
JM016	030	1	2	14	1	390	402	00
JM016	031	1	1	14	1	400	406	00
JM016	032	1	1	14	1	400	392	00
JM016	033	1	7	0	2	420	323	00
JM016	034	1	2	14	2	300	641	00
JM016	035	1	7	4	1	320	589	00
JM016	036	1	2	14	1	590	517	00
JM016	037	1	7	1	2	620	461	00
JM016	038	1	1	14	1	650	489	00
JM016	039	1	7	1	1	690	446	00
JM016	040	1	7	1	1	740	450	00
JM016	041	1	2	14	1	830	422	00
JM016	042	1	7	1	2	720	349	00
JM016	043	1	1	14	1	990	241	00
JM016	044	1	7	4	2	1230	214	00
JM016	045	1	1	14	1	650	123	00
JM016	046	1	2	14	1	570	217	00
JM016	047	1	2	14	1	700	171	00
JM016	048	1	3	14	1	800	281	00
JM016	049	1	3	14	1	800	281	00
JM016	050	1	2	14	1	800	281	00
JM016	051	1	2	14	3	820	435	00
JM016	052	1	1	14	2	820	502	00
JM016	053	1	2	14	2	1000	322	00
JM016	054	1	2	14	2	1150	269	00
JM016	055	1	2	14	1	1330	489	00
JM016	056	1	7	4	3	1480	111	00
JM016	057	1	2	14	6	1700	74	00
JM016	058	1	7	4	2	1510	232	00
JM016	059	1	7	4	5	1720	314	00
JM016	060	1	2	14	1	1880	259	00
JM016	061	1	2	14	1	1910	519	00
JM016	062	1	7	0	3	1970	392	00
JM016	063	1	2	14	1	1980	386	00
JM016	064	1	3	14	1	1980	386	00
JM016	065	1	7	4	1	2010	290	00
JM016	066	1	7	0	2	2120	444	00
JM016	067	1	1	14	1	2390	373	00

Table 14.1 - continued

```
JM016 068 1  7  0  2 2400  333 00
JM016 069 1  1 14  1 2480  364 00
JM016 070 1  3 14  1 2510  392 00
JM016 071 1  2 14  1 2530  457 00
JM016 072 1  7  0  3 2520  346 00
JM016 073 1  7  0  2 2550  364 00
JM016 074 1  3 14  2 2630  398 00
JM016 075 1  2  0  1 2790  317 00
JM016 076 1  7  0  3 2820  339 00
JM016 077 1  1  0  1 2870  258 00
JM016 078 1  2 14  1 2820  551 00
JM016 079 1  1 14  2 2920  524 00
JM016 080 1  2  0  1 3390  214 00
JM016 081 1  7  0  3 3350   86 00
JM016 082 1  7  0  2   40  293 00
JM016 083 1  2 14  1   60  287 00
JM016 084 1  2 14  1  490  418 00
JM016 085 1  2 14  1  520  408 00
JM016 086 1  1  0  2  870  342 00
JM016 087 1  3  0  1  860  155 00
JM016 088 1  2 14  1 1090  649 00
JM016 089 1  7  0  3 1140  858 00
JM016 090 1  7  0  5 1160  774 00
JM016 091 1  3 14  6 1170  500 00
JM016 092 1  2 14  1 1260  599 00
JM016 093 1  7  0  2 1470  135 00
 0720 1000 0147 1495 0000 0000 045 084 000 083 093 000
JM016 064 2 015 050 0270 11784 01143 0046 09146 00305 00540 999 1 0800 02133030
JM016       3 677810 421567 00     250000    7 0037200 0048 0026 .09   0   0 .02   0
JM016       4    0 .47    0    0    0 .18 .04 .08 .01    0    0    0 .11    0    0    0    0
JM017 001 1  2 14  2 2970   98 00 144 000 0000075000 0 1
JM017 002 1  7  0  1 2920  100 00
JM017 003 1  2 14  1 2620   41 00
JM017 004 1  2 14  1 2510  115 00
JM017 005 1  7  0  1 2580  142 00
JM017 006 1  7  0  3 2760  262 00
JM017 007 1  7  4  3 2740  368 00
JM017 008 1  4 16  1 2660  225 00
JM017 009 1  7  0  2 2630  276 00
JM017 010 1  3 14  1 2540  220 00
JM017 011 1  7  0  3 2490  268 00
JM017 012 1  2 14  1 2410  279 00
JM017 013 1  1 14  1 2320  108 00
JM017 014 1  7  0  2 2410  446 00
JM017 015 1  7  4  1 2380  347 00
JM017 016 1  7  4  1 2370  344 00
JM017 017 1  7  1  1 2370  347 00
JM017 018 1  7  0  1 2360  428 00
JM017 019 1  3 14  1 2350  439 00
JM017 020 1  7  0  1 2340  292 00
JM017 021 1  2 14  1 2330  301 00
JM017 022 1  7  4  1 2330  277 00
JM017 023 1  7  0  1 2330  282 00
JM017 024 1  7  0  1 2340  365 00
JM017 025 1  2  0  1 2350  481 00
JM017 026 1  7  4  1 2320  490 00
JM017 027 1  2 14  1 2310  265 00
JM017 028 1  2 14  1 2310  265 00
JM017 029 1  7  0  3 2310  304 00
JM017 030 1  7  0  2 2500  213 00
JM017 031 1  2 14  1 2290  341 00
JM017 032 1  2 14  2 2290  399 00
```

Table 14.1 - continued

JM017	033	1	7	1	1	2290	459	00
JM017	034	1	1	0	1	2280	275	00
JM017	035	1	7	1	1	2270	214	00
JM017	036	1	0	0	14	2260	288	01
JM017	037	1	2	14	1	2260	192	00
JM017	038	1	2	13	1	2230	86	00
JM017	039	1	7	0	1	2260	435	00
JM017	040	1	3	14	2	2260	435	00
JM017	041	1	7	0	1	2240	454	00
JM017	042	1	2	14	1	2240	328	00
JM017	043	1	7	4	1	2230	187	00
JM017	044	1	7	1	1	2210	139	00
JM017	045	1	3	0	1	2190	220	00
JM017	046	1	7	0	1	2210	353	00
JM017	047	1	1	14	1	2220	535	00
JM017	048	1	2	12	1	2180	406	00
JM017	049	1	2	14	1	2190	399	00
JM017	050	1	7	0	1	2190	307	00
JM017	051	1	3	0	1	2190	307	00
JM017	052	1	2	0	1	2190	380	00
JM017	053	1	2	0	1	2180	356	00
JM017	054	1	3	14	1	2180	366	00
JM017	055	1	7	0	1	2170	401	00
JM017	056	1	7	1	1	2170	322	00
JM017	057	1	2	14	1	2170	277	00
JM017	058	1	2	14	1	2170	325	00
JM017	059	1	2	14	1	2160	130	00
JM017	060	1	3	15	2	2160	130	00
JM017	061	1	1	14	1	2160	152	00
JM017	062	1	2	14	1	2150	154	00
JM017	063	1	1	15	1	2110	195	00
JM017	064	1	7	1	1	2110	237	00
JM017	065	1	1	14	1	2100	268	00
JM017	066	1	2	14	1	2130	314	00
JM017	067	1	7	1	1	2120	380	00
JM017	068	1	2	14	1	2100	379	00
JM017	069	1	3	14	1	2180	397	00
JM017	070	1	7	1	2	2050	417	00
JM017	071	1	1	14	1	2070	342	00
JM017	072	1	5	0	5	2080	345	00
JM017	073	1	7	4	5	2080	344	00
JM017	074	1	7	4	1	2080	339	00
JM017	075	1	7	1	1	2080	356	00
JM017	076	1	1	14	1	2090	209	00
JM017	077	1	7	0	1	2060	217	00
JM017	078	1	2	14	1	2040	193	00
JM017	079	1	7	1	2	2050	162	00
JM017	080	1	7	4	1	2050	153	00
JM017	081	1	7	4	1	2080	63	00
JM017	082	1	2	14	1	1960	72	00
JM017	083	1	7	4	1	1840	80	00
JM017	084	1	7	4	6	1900	120	00
JM017	085	1	7	1	1	1960	116	00
JM017	086	1	7	1	2	1960	171	00
JM017	087	1	7	1	1	1940	190	00
JM017	088	1	7	0	1	2020	326	00
JM017	089	1	7	1	1	1940	369	00
JM017	090	1	2	14	1	1950	328	00
JM017	091	1	2	14	1	1950	273	00
JM017	092	1	4	10	1	1950	258	00
JM017	093	1	1	14	1	1760	332	00
JM017	094	1	2	15	2	2110	503	00

Table 14.1 - continued

```
JM017 095 1  3  0  1 2080  544 00
JM017 096 1  4 10 11 1890  148 00
JM017 097 1  7  1  1 1530   71 00
JM017 098 1  7  0  1 1240  222 00
JM017 099 1  2  0  1 1010  252 00
JM017 100 1  2 14  2 1000  258 00
JM017 101 1  2  0  1  930  254 00
JM017 102 1  7  0  1  930  124 00
JM017 103 1  7  1  1  850   51 00
JM017 104 1  7  1  1  750   34 00
JM017 105 1  7  0  1  750   34 00
JM017 106 1  2 14  1  790  428 00
JM017 107 1  7  1  1  750  588 00
JM017 108 1  7  4  1  710  216 00
JM017 109 1  7  1  1  750  259 00
JM017 110 1  2 14  1  640  324 00
JM017 111 1  2 14  2  670  472 00
JM017 112 1  7  1  1  610  525 00
JM017 113 1  1 14  1  620  636 00
JM017 114 1  7  4  1  620  641 00
JM017 115 1  7  4  1  620  641 00
JM017 116 1  2 14  5  530  444 00
JM017 117 1  2 14  1  530  328 00
JM017 118 1  1 14  1  530  217 00
JM017 119 1  7  4  2  460  421 00
JM017 120 1  1 14  1  430  441 00
JM017 121 1  7  0  2  410  116 00
JM017 122 1  7  0  5  390  530 00
JM017 123 1  2 14  1  400  482 00
JM017 124 1  1 14  1  380  393 00
JM017 125 1  7  1  2  380  482 00
JM017 126 1  7  1  2  340  445 00
JM017 127 1  7  4  1  330  348 00
JM017 128 1  1  0  1  310  346 00
JM017 129 1  1 14  2  310  346 00
JM017 130 1  2 14  1  290  329 00
JM017 131 1  7  0  1  290  400 00
JM017 132 1  3 14  6  350  543 00
JM017 133 1  7  1  7  270  216 00
JM017 134 1  7  4  1  200  237 00
JM017 135 1  1 14  7  220  304 00
JM017 136 1  7  0  3   90  332 00
JM017 137 1  7  1  1  110  190 00
JM017 138 1  2 14  1   50   49 00
JM017 139 1  2  0  2 3540  325 00
JM017 140 1  2 14  1 3570  225 00
JM017 141 1  7  4  8 3370  103 00
JM017 142 1  1 13  1  580  815 00
JM017 143 1  2 14  1  560 1107 00
JM017 144 1  1 14  1  500 1251 00
JM017 064 2 015 050 1350 11784 01067 0061 11204 00305 00460 999 1 0800 02133030
JM017     3 677650 421587 00     075000  12 0192000 0048 0026 .17   0 .01 .01   0
JM017     4 .01 .37 .02   0   0 .18 .01 .04 .02 .01   0   0 .13   0   0   0   0
JM018 001 1  1  0  3   40  289 00  15 000 0000040000 0 1
JM018 002 1  1 13  1  160  203 00
JM018 003 1  1 13  1  140  118 00
JM018 004 1  7  0  3  810  142 00
JM018 005 1  1 13  1  570  297 00
JM018 006 1  2  0  1 1640  219 00
JM018 007 1  2  0  1 2110  224 00
JM018 008 1  1 14  1 2210  210 00
JM018 009 1  2 14  1 2200   91 00
```

Table 14.1 - continued

```
JM018 010 1  2  0  3 2350  258 00
JM018 011 1  3 14  6 2430   96 00
JM018 012 1  1 14  2 2630  368 00
JM018 013 1  2  0  2 2650  327 00
JM018 014 1  7  1 11 3020  272 00
JM018 015 1  1  0  1 3400  272 00
JM018 064 2 000 015 2700 11814 01799 0015 10671 00335 00200 968 2 0800 02133030
JM018     3 678060 421598 00     040000    5 0037500 0086 0028 .07   0 .20   0   0
JM018     4   0 .27   0   0   0 .07 .13 .27   0   0   0   0   0   0   0   0   0
JM019 001 1  7  0  1 1370  154 00  75 000 0000112500 0 9
JM019 002 1  2 14  1 1350  160 00
JM019 003 1  1 14  2 1320  193 00
JM019 004 1  7  0  1  970  390 00
JM019 005 1  7  4  4  910  230 00
JM019 006 1  7  4  2  980  149 00
JM019 007 0  1 14  1  960  139 00
JM019 008 1  7  0  1  920  139 00
JM019 009 1  7  4  1  810  144 00
JM019 010 1  1 14  1  490  365 00
JM019 011 1  3 14  3  450  355 00
JM019 012 1  3 14  1  410  228 00
JM019 013 1  0 32 14  350  284 00
JM019 014 1  7  4  2  290  342 00
JM019 015 1  1 14  1  280  248 00
JM019 016 1  7  0  1  240  206 00
JM019 017 1  7  1  1  250  169 00
JM019 018 1  7  0  3  280  112 00
JM019 019 1  7  0  8  170  379 00
JM019 020 1  3 14  3 3530  502 00
JM019 021 1  7  4  6   80  275 00
JM019 022 1  7  4 14   60  208 00
JM019 023 1  3 14  1   30  152 00
JM019 024 1  7  4  3 3490   85 00
JM019 025 1  2 14  1 3300   94 00
JM019 026 1  3 13  1 3230  100 00
JM019 027 1  7  4  5 3410  134 00
JM019 028 1  3 14  1 2930   78 00
JM019 029 1  1 14  1 2650  140 00
JM019 030 1  2 14  1 2650  136 00
JM019 031 1  7  1  1 2870  202 00
JM019 032 1  1 14  1 2940  295 00
JM019 033 1  2 14  1 2950  312 00
JM019 034 1  7  0  3 2960  287 00
JM019 035 1  7  4 11 2840  346 00
JM019 036 1  7  1  2 3050  428 00
JM019 037 1  7  1  1 3060  420 00
JM019 038 1  2 14 11 3130  318 00
JM019 039 1  7  4  1 1660  124 00
JM019 040 1  1 14  1 1720  111 00
JM019 041 1  7  0  1 1750  101 00
JM019 042 1  2 14  1 1870   79 00
JM019 043 1  7  4  6 1900  108 00
JM019 044 1  1 14  2 1900  108 00
JM019 045 1  7  4  3 1930  207 00
JM019 046 1  2 14  2 2120  204 00
JM019 047 1  4 10  6 2270  118 00
JM019 048 1  3 13  1 2300  177 00
JM019 049 1  7  0  1 2320  191 00
JM019 050 1  7  4  1 2360  234 00
JM019 051 1  2 14  2 2420  268 00
JM019 052 1  1 14  1 2460  272 00
JM019 053 1  3 14  1 2460  264 00
```

Table 14.1 - continued

```
JM019 054 1  7  1  1 2470  266 00
JM019 055 1  7  4  2 2470  274 00
JM019 056 1  1 14  1 2510  262 00
JM019 057 1  2 16  2 2330  272 00
JM019 058 1  2 14  1 2380  319 00
JM019 059 1  7  4  2 2290  398 00
JM019 060 1  2 14  1 2270  454 00
JM019 061 1  7  4  1 2170  414 00
JM019 062 1  3 14  1 2130  475 00
JM019 063 1  7  1  2 2140  470 00
JM019 064 1  7  4  1 2110  466 00
JM019 065 1  2 14  1 2130  586 00
JM019 066 1  1 14  1 2110  598 00
JM019 067 1  7  0  1 2130  687 00
JM019 068 1  7  1  1 2140  695 00
JM019 069 1  2 14  1 2140  699 00
JM019 070 1  3 14  1 2200  577 00
JM019 071 1  3 14  2 2070  536 00
JM019 072 1  2 14  1 2090  599 00
JM019 073 1  3 14  1 2100  628 00
JM019 074 1  3 14  1 2100  628 00
JM019 075 1  3 14  1 2100  628 00
 2790 0730 0000 0000 0000 0000 040 000 000 075 000 000
JM019 064 2 015 050 1350 11784 01905 0122 14177 00290 00430 987 2 0800 02133030
JM019     3 677480 421618 00    112500   7 0066666 0057 0028 .09   0 .03 .01   0
JM019     4   0 .48   0   0   0 .13   0   0   0   0   0   0 .23   0 .01   0   0
JM021 001 1  1 14  1  580  167 00  23 000 0000038400 0 1
JM021 002 1  7  1  2 1270  100 00
JM021 003 1  3 14  1 1350  127 00
JM021 004 1  1 14  1 1410  139 00
JM021 005 1  3 14  7 1520  180 00
JM021 006 1  7  4  3 1900   69 00
JM021 007 1  2 15  1 1910  137 00
JM021 008 1  3 14  2 2000  186 00
JM021 009 1  2 13  1 2030  425 00
JM021 010 1  7  4  1 2060  461 00
JM021 011 1  2 14  1 2350  287 00
JM021 012 1  3  0  1 2380  249 00
JM021 013 1  2 14  1 2410  252 00
JM021 014 1  7  4  1 2480  334 00
JM021 015 1  7  0  3 2590  281 00
JM021 016 1  7  0  1 2640  283 00
JM021 017 1  2  0  1 2730  230 00
JM021 018 1  7  4  3 2720   75 00
JM021 019 1  7  4  2 2920  154 00
JM021 020 1  1 14  1 3110  545 00
JM021 021 1  7  1  2 3100  282 00
JM021 022 1  7  4  1 3440  213 00
JM021 023 1  7  0  2 3290  642 00
JM021 064 2 015 050 2130 11229 01982 0106 15854 00345 00110 713 2 0800 02133030
JM021     3 677520 421652 00    038400   7 0059895 0038 0028 .09   0 .04   0   0
JM021     4   0 .35 .04   0   0 .13   0 .04 .04   0   0   0 .26   0   0   0   0
JM022 001 1  2 15  4 2880   14 00  28 000 0000002500 0 1
JM022 002 1  3 14  4 2890   12 00
JM022 003 1  3 15  4 2810    8 00
JM022 004 1  3 13  4 2810    8 00
JM022 005 1  4 15  4 2810    8 00
JM022 006 1  3 15  4 2810    8 00
JM022 007 1  3 15  4 2810    8 00
JM022 008 1  3 15  4 2810    8 00
JM022 009 1  3 15  4 2810    8 00
JM022 010 1  3 15  9 2810    8 00
```

Table 14.1 - continued

```
JM022 011 1   3  0   4 2810     8 00
JM022 012 1   3  0   4 2810     8 00
JM022 013 1   7  0   2 2810     8 00
JM022 014 1   4 17   4 2810     8 00
JM022 015 1   2 15   4 3290     8 00
JM022 016 1   3  0   4 2810     8 00
JM022 017 1   3 14   4 2810     8 00
JM022 018 1   5  0   4 2860    16 00
JM022 019 1   4 15   3 2300    21 00
JM022 020 1   2 14   1 2460    21 00
JM021 021 1   7  1   3 2700    19 00
JM022 022 1   3 14   2 1050     3 00
JM022 023 1   1 10   2 2350    81 00
JM022 024 1   2 13   1 2430    46 00
JM022 025 1   7  0   1 2490    44 00
JM022 026 1   3  0   4 2870    32 00
JM022 027 1   7  0   3 2890    46 00
JM022 028 1   2 13   1 2850    45 00
JM022 064 2 000 450 2150 11662 01220 0092 08537 00168 01000 999 1 0800 02133030
JM022     3 677390 421556 00     000250    8 0000000 0029 0023 .04    0 .11 .04    0
JM022     4    0 .14 .36    0    0 .11    0    0 .14 .04    0    0    0 .04    0    0    0
JM023 001 1   0  0   0 1440    25 01  27 000 0000004500 0 1
JM023 002 1   2 14   1 1110    19 00
JM023 003 1   1 14   1  820   116 00
JM023 004 1   2 14   1  840   121 00
JM023 005 1   2 14   1  920    86 00
JM023 006 1   7  4   1  930    69 00
JM023 007 1   7  0   1 1260    86 00
JM023 008 1   3 14   1 1380    67 00
JM023 009 1   2  0   1 1410    76 00
JM023 010 1   2 14   1 1360   135 00
JM023 011 1   2 14   3 1570   124 00
JM023 012 1   7  0   2 1660   110 00
JM023 013 1   2 14   3 1740   115 00
JM023 014 1   7  0   3 1740   124 00
JM023 015 1   1 14   1 1920   108 00
JM023 016 1   1 14   1 2120    85 00
JM023 017 1   3 14   1 2080   136 00
JM023 018 1   7  0   1 2130   203 00
JM023 019 1   2 14   1 2290    62 00
JM023 020 1   2 14   1 2490    66 00
JM023 021 1   3 14   4 2480    79 00
JM023 022 1   7  0   3 2710    55 00
JM023 023 1   7  0   1 2550   146 00
JM023 024 1   7  0   1 2600   166 00
JM023 025 1   7  4   1 2560   244 00
JM023 026 1   7  0   2 2770   210 00
JM023 027 1   2 14   2 2940   120 00
JM023 064 2 000 015 2300 11860 01524 0030 19360 00350 00100 684 2 0800 02133030
JM023     3 676790 421669 00     004500    3 0600000 0029 0018    0    0    0    0    0
JM023     4    0 .56    0    0    0 .30    0 .04    0    0    0    0 .07    0    0    0    0
JM024 001 1   1 14   1  980    69 00  32 000 0000013440 0 1
JM024 002 1   7  0   1  960    67 00
JM024 003 1   7  4   1  950   117 00
JM024 004 1   7  4   2  980   154 00
JM024 005 1   7  0   2 1080   199 00
JM024 006 1   7  0   1 1090   172 00
JM024 007 1   3  0   1 1100   174 00
JM024 008 1   7  4   1 1160   181 00
JM024 009 1   7  0   1 1180   183 00
JM024 010 1   2 14   1 1190   178 00
JM024 011 1   1 14   1 1190   175 00
```

Table 14.1 - continued

```
JM024 012 1  7  4  1 1200   158 00
JM024 013 1  7  0  3 1260   215 00
JM024 014 1  7  4  2 1130   153 00
JM024 015 1  7  4  1 1120   211 00
JM024 016 1  3 14  1 1140    82 00
JM024 017 1  2 14  1 1480   106 00
JM024 018 1  7  4  1 1330    58 00
JM024 019 1  7  4  3 1440    54 00
JM024 020 1  1 14  1 1730    80 00
JM024 021 1  1 13  1 1750   188 00
JM024 022 1  3 14  1 2180   234 00
JM024 023 1  7  4  1 2380   204 00
JM024 024 1  7  0  3 2380   201 00
JM024 025 1  2 14  1 2510   272 00
JM024 026 1  1 14  1 2550   266 00
JM024 027 1  2 14  1 2830   224 00
JM024 028 1  1 14  1 3050    97 00
JM024 029 1  7  4  6 3050    80 00
JM024 030 1  1 14 15   60    23 00
JM024 031 1  3 14  1 2240   103 00
JM024 032 1  7  0  1 2190    76 00
JM024 064 2 030 050 1500 11814 01448 0030 16220 00320 00030 750 2 0800 02133030
JM024     3 677120 421661 01     013440    4 0238095 0048 0017   0    0 .03    0    0
JM024     4    0 .41    0    0    0 .22    0    0 .03    0    0    0 .31    0    0    0    0
JM025 001 1  4 10  1 1400     7 00  23 000 0000011200 0 1
JM025 002 1  7  0  1 2700    25 00
JM025 003 1  3 14  1 2490    65 00
JM025 004 1  7  0  5 2420   129 00
JM025 005 1  1 15  1 2050   189 00
JM025 006 1  4  0  2 2170   226 00
JM025 007 1  7  0  3 2220   247 00
JM025 008 1  1 14  1 2230   278 00
JM025 009 1  7  4  1 2550   158 00
JM025 010 1  7  0  3 2630   170 00
JM025 011 1  2 14  1 2670   183 00
JM025 012 1  2 14  1 2630    63 00
JM025 013 1  7  0  1 2660   204 00
JM025 014 1  7  1  1 2760   174 00
JM025 015 1  3  0  1 2810   172 00
JM025 016 1  2 13  1 2820    44 00
JM025 017 1  1 14  2 3000    52 00
JM025 018 1  7  1  1 2910   198 00
JM025 019 1  7  1  1 2890   220 00
JM025 020 1  2 14  1 2980   199 00
JM025 021 1  1 14  1 3110   228 00
JM025 022 1  7  0  3 3590   121 00
JM025 023 1  2 14  1  330    99 00
JM025 064 2 015 050 1800 11677 00991 0012 13170 00167 00470 999 2 0800 02133030
JM025     3 676640 421611 00     011200    8 0205357 0038 0017 .13    0 .04 .04    0
JM025     4    0 .35 .04    0    0 .26    0    0 .04    0    0 .04 .04    0    0    0    0
JM026 001 1  7  4  6   40     8 00  70 000 0000021600 0 1
JM026 002 1  7  0  1 1820   114 00
JM026 003 1  2 14  1 1740   164 00
JM026 004 1  7  4  2 1730   163 00
JM026 005 1  7  1  1 1770   200 00
JM026 006 1  7  3  2 1770   199 00
JM026 007 1  3  0  1 1680   198 00
JM026 008 1  2 13  6 1590   207 00
JM026 009 1  7  3  1 1500   217 00
JM026 010 1  7  0  1 1470   225 00
JM026 011 1  2  0  1 1640   190 00
JM026 012 1  3 14  1 1920   206 00
```

Table 14.1 - continued

JM026	013	1	2	0	1	2030	250	00
JM026	014	1	7	0	1	2040	256	00
JM026	015	1	7	4	1	2010	267	00
JM026	016	1	7	0	1	1960	225	00
JM026	017	1	3	14	1	2080	138	00
JM026	018	1	2	14	1	2220	151	00
JM026	019	1	7	1	1	2270	159	00
JM026	020	1	2	14	1	2240	213	00
JM026	021	1	7	4	1	2200	260	00
JM026	022	1	2	14	2	2390	213	00
JM026	023	1	7	0	5	2540	165	00
JM026	024	1	2	0	1	2380	66	00
JM026	025	1	7	4	1	2280	74	00
JM026	026	1	1	0	1	2710	64	00
JM026	027	1	7	0	1	2760	80	00
JM026	028	1	4	10	1	2760	101	00
JM026	029	1	7	3	1	2850	77	00
JM026	030	1	3	14	1	2970	134	00
JM026	031	1	7	3	5	3280	174	00
JM026	032	1	1	14	1	3360	151	00
JM026	033	1	2	14	1	3380	159	00
JM026	034	1	2	13	1	3430	183	00
JM026	035	1	7	1	1	3500	296	00
JM026	036	1	7	4	1	3510	293	00
JM026	037	1	2	14	1	3510	40	00
JM026	038	1	1	15	1	3560	96	00
JM026	039	1	2	14	1	3560	184	00
JM026	040	1	7	1	1	3560	222	00
JM026	041	1	3	12	1	80	212	00
JM026	042	1	7	4	1	90	239	00
JM026	043	1	4	3	3	70	270	00
JM026	044	1	2	14	1	110	280	00
JM026	045	1	7	4	1	130	203	00
JM026	046	1	2	13	2	160	218	00
JM026	047	1	7	1	1	150	108	00
JM026	048	1	7	4	1	210	264	00
JM026	049	1	2	14	1	210	264	00
JM026	050	1	2	14	1	230	265	00
JM026	051	1	3	0	1	290	236	00
JM026	052	1	7	0	6	320	153	00
JM026	053	1	7	0	1	380	152	00
JM026	054	1	7	4	1	330	185	00
JM026	055	1	3	0	6	330	183	00
JM026	056	1	2	14	1	360	188	00
JM026	057	1	2	14	1	460	146	00
JM026	058	1	7	4	1	800	26	00
JM026	059	1	7	4	1	730	46	00
JM026	060	1	7	1	1	1110	112	00
JM026	061	1	2	14	1	1300	94	00
JM026	062	1	7	4	1	1240	124	00
JM026	063	1	1	14	1	1240	134	00
JM026	064	1	7	1	1	1220	152	00
JM026	065	1	7	0	1	1230	173	00
JM026	066	1	1	0	1	1290	182	00
JM026	067	1	7	4	1	1350	121	00
JM026	068	1	7	1	1	1400	127	00
JM026	069	1	7	0	1	1440	66	00
JM026	070	1	7	4	1	490	168	00

```
JM026 064 2 015 050 1450 11808 01250 0009 14177 00314 00360 994 2 0800 02133030
JM026     3 677080 421622 00    021600  11 0324074 0057 0023 .11   0 .10 .01   0
JM026     4 .01 .26 .01   0   0 .14 .03 .04 .04   0   0   0 .21   0   0   0   0
JM027 001 1  3 14  1  280   37 00  53 000 0000007500 0 1
```

Table 14.1 - continued

```
JM027 002 1   2 14   1  310    38 00
JM027 003 1   7  0   2  310   183 00
JM027 004 1   7  4  15  210   214 00
JM027 005 1   7  1   2  140    83 00
JM027 006 1   3 14   1   60   171 00
JM027 007 1   7  0   7 3580   323 00
JM027 008 1   3 14   1 3570   204 00
JM027 009 1   1 14   1 3440   266 00
JM027 010 1   7  1   2 3280    96 00
JM027 011 1   2 14   1 3220   153 00
JM027 012 1   2 14   2 2930   132 00
JM027 013 1   2 14   1 2790   128 00
JM027 014 1   2  0   2 2560   105 00
JM027 015 1   7  0   2 2370    48 00
JM027 016 1   7  4   1 2270    61 00
JM027 017 1   7  4   2 2220    56 00
JM027 018 1   2 14   1 2090    59 00
JM027 019 1   7  1   2 1960   108 00
JM027 020 1   3 14   2 1920    98 00
JM027 021 1   2 14   2 2030   170 00
JM027 022 1   7  4   1 1900   158 00
JM027 023 1   7  0   1 1920   328 00
JM027 024 1   7  1   1 1850   180 00
JM027 025 1   7  4   1 1860   114 00
JM027 026 1   2 14   1 1780   278 00
JM027 027 1   2 14   1 1790   191 00
JM027 028 1   7  4   1 1710    65 00
JM027 029 1   2  0   1 1710    94 00
JM027 030 1   7  1   1 1740   102 00
JM027 031 1   2  0   2 1780   114 00
JM027 032 1   7  0   1 1780   124 00
JM027 033 1   7  0   2 1750   123 00
JM027 034 1   3 14   1 1580    79 00
JM027 035 1   1 14   5 1580    92 00
JM027 036 1   1 14   1 1710   131 00
JM027 037 1   7  4   1 1700   145 00
JM027 038 1   3 14   1 1770   163 00
JM027 039 1   7  4   1 1760   178 00
JM027 040 1   7  1   1 1600   113 00
JM027 041 1   3 14   1 1590   132 00
JM027 042 1   2 14   1 1560   132 00
JM027 043 1   1 13   1 1560   138 00
JM027 044 1   2 14   1 1560   142 00
JM027 045 1   1 14   1 1520   129 00
JM027 046 1   2 14   1 1680   162 00
JM027 047 1   7  1   1 1640   192 00
JM027 048 1   7  0   1 1500   183 00
JM027 049 1   2 14   1 1220   146 00
JM027 050 1   2 14   1 1200   136 00
JM027 051 1   7  0   3 1160    71 00
JM027 052 1   7  1   2  910    86 00
JM027 053 1   1 14   2  810    59 00
JM027 064 2 015 050 1150 11707 00838 0015 12729 00213 00560 999 1 0800 02133030
JM027     3 677020 421602 00     007500    5 0706666 0048 0023 .15    0 .02    0    0
JM027     4    0 .47    0    0    0 .15    0 .06    0    0    0    0 .15    0    0    0    0
JM028 001 1   2 14   1  640   138 00  54 000 0000025000 0 1
JM028 002 1   7  0   5  910   151 00
JM028 003 1   7  4   1  940   157 00
JM028 004 1   3 14   1  950   162 00
JM028 005 1   3 14   1  950   162 00
JM028 006 1   7  0   1 1050   261 00
JM028 007 1   4 12   5 1050   210 00
```

Table 14.1 - continued

```
JM028 008 1   3 14   1 1070   224 00
JM028 009 1   3 14   1 1110   172 00
JM028 010 1   7  0   3 1310   168 00
JM028 011 1   7  4   2 1200   240 00
JM028 012 1   2 14   1 1290   254 00
JM028 013 1   2 14   1 1240   335 00
JM028 014 1   7  4   1 1210   360 00
JM028 015 1   3 14   1 1200   326 00
JM028 016 1   7  0   2 1440   216 00
JM028 017 1   3  0   1 1440   108 00
JM028 018 1   7  0   3 1470   260 00
JM028 019 1   7  0   6 1590   193 00
JM028 020 1   2 14   1 1590   212 00
JM028 021 1   7  0   3 1630   306 00
JM028 022 1   7  1   2 1640   310 00
JM028 023 1   7  0   1 1630   363 00
JM028 024 1   7  0   2 1750   418 00
JM028 025 1   3 14   1 1770   406 00
JM028 026 1   1 14   1 1810   388 00
JM028 027 1   1 14   1 1810   388 00
JM028 028 1   7  0   2 1800   354 00
JM028 029 1   0  0   2 1820   352 01
JM028 030 1   2 14   1 1830   321 00
JM028 031 1   2 14   1 1790   275 00
JM028 032 1   4 12  11 1880   303 00
JM028 033 1   2 14   1 1930   298 00
JM028 034 1   7  1   1 2080   292 00
JM028 035 1   7  4   1 1830   194 00
JM028 036 1   7  0   3 1970   150 00
JM028 037 1   7  4   1 2020   110 00
JM028 038 1   3  0   2 2020   116 00
JM028 039 1   7  0   3 2050   129 00
JM028 040 1   7  4   1 2400   104 00
JM028 041 1   2 14   1 2400   120 00
JM028 042 1   1 14   1 2780    98 00
JM028 043 1   3 14   1 2630   248 00
JM028 044 1   2 14   1 2700   174 00
JM028 045 1   7  0   1 2800   215 00
JM028 046 1   1 14   1 2930   368 00
JM028 047 1   3  0   1 3370   244 00
JM028 048 1   3 14   5 3460   320 00
JM028 049 1   2 14   1 3500   230 00
JM028 050 1   7  4   1 3430   137 00
JM028 051 1   3 14   3  110   200 00
JM028 052 1   7  0   6  550   384 00
JM028 053 1   7  4   1  700   724 00
JM028 054 1   2 16   1  960   413 00
JM028 064 2 015 050 1550 11805 01524 0082 14695 00295 00390 967 2 0800 02133030
JM028     3 676760 421626 00     025000    6 0216000 0057 0017 .04    0    0    0    0
JM028     4 .04 .43    0    0    0 .26    0    0 .06    0    0    0 .15    0    0    0    0
JM030 001 1   0  0   0 3595   377 04   12 000 0000016000 0 1
JM030 002 1   0  0   0 3570   406 04
JM030 003 1   0  0   0 3535   394 04
JM030 004 1   0  0   0 3550   359 04
JM030 005 1   0  0   0 3055   179 04
JM030 006 1   0  0   0 3070   133 04
JM030 007 1   0  0   0 3000   139 04
JM030 008 1   0  0   0 2940   161 04
JM030 009 1   0  0   0 1785   359 04
JM030 010 1   0  0   0 1750   390 04
JM030 011 1   0  0   0 1775   406 04
JM030 012 1   0  0   0 1825   393 04
```

Table 14.1 - continued

```
JM030 064 2 015 050 2700 11692 00762 0015 22866 00168 00240 744 2 0800 02133030
JM030     3 676190 421692 00     016000   -1 0800000 0010 0015   0    0    0    0    0
JM030     4    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
JM031 001 1   3 14   3 1630   240 00   17 000 0000015000 0 1
JM031 002 1   4 13   6 1630   258 00
JM031 003 1   0  0   0 2020   106 00
JM031 004 1   0  0  15 2840    33 08
JM031 005 1   7  0   2 3010    39 00
JM031 006 1   0  0  15 3360    20 08
JM031 007 1   0 31  15 3440    22 00
JM031 008 1   0  0   2  360    47 08
JM031 009 1   0  0  15 3520    80 08
JM031 010 1   0 30  15 3420    99 00
JM031 011 1   3  0   2 3380   100 00
JM031 012 1   2 14   1 3220   103 00
JM031 013 1   0 30  15 3150    89 00
JM031 014 1   2 14   1 3090   114 00
JM031 015 1   1 14   2 3090   117 00
JM031 016 1   0 30  15 2940   163 00
JM031 017 1   0  0  15 3090   212 08
JM031 022 2 050 450 0500 11692 00500 0030 00500 00030 00000 529 2 1200 22323020
JM031     3 671880 421265 00     015000    5 0113333 0010 0005   0    0 .06    0    0
JM031     4    0 .24    0 .18 .06 .06    0    0 .06    0    0    0    0    0    0    0    0
JM032 001 1   3 14   2  320   415 00   26 000 0000060000 0 9
JM032 002 1   3  0   1  820   182 00
JM032 003 1   1  0   2  780    77 00
JM032 004 1   7  4   2  570    86 00
JM032 005 1   1  0   2 1120    82 00
JM032 006 1   5  0   3 1910    35 00
JM032 007 1   7  0   6 2110    88 00
JM032 008 1   2 14   1 2000   227 00
JM032 009 1   7  1   1 2450   112 00
JM032 010 1   4 11   3 2580   123 00
JM032 011 1   2 14   2 2520   148 00
JM032 012 1   3 14   6 2490   206 00
JM032 013 1   7  4   3 2840   208 00
JM032 014 1   3  0   1 2990   224 00
JM032 015 1   7  0   3 3100   396 00
JM032 016 1   1 14   2 2910   120 00
JM032 017 1   1 15  11 3180   112 00
JM032 018 1   7  0   1 2650   170 00
JM032 019 1   7  0   6 2600   270 00
JM032 020 1   7  4   6 2560   255 00
JM032 021 1   1  0   3 2580   381 00
JM032 022 1   1 14   3 2540   565 00
JM032 023 1   7  4   3 2550   455 00
JM032 024 1   1 14   6 2510   423 00
JM032 025 1   4 10   2 2870   156 00
JM032 026 1   4 10  11 2100   882 00
 2840 0264 0000 0000 0000 0000 018 000 000 026 000 000
JM032 053 2 030 030 0100 11829 04116 0167 04116 00167 00200 770 3 0800 01323020
JM032     3 671580 421355 00     060000    9 0043333 0010 0003 .04    0    0 .08 .04
JM032     4    0 .27 .04    0    0 .15 .12    0 .08 .04    0    0 .15    0    0    0    0
JM033 001 1   2  0   3 2080   146 00   15 000 0000035000 0 1
JM033 002 1   2  0   2 1690   109 00
JM033 003 1   1  0   1 1400   136 00
JM033 004 1   2  0   2  620    20 00
JM033 005 1   7  0   3  400    78 00
JM033 006 1   2  0   2  120    74 00
JM033 007 1   7  0   3 3540    90 00
JM033 008 1   7  0   3 3520   107 00
JM033 009 1   2  0   3 3500   157 00
```

Table 14.1 - continued

```
JM033 010 1  1  0  2  170   267 00
JM033 011 1  7  2  2  590   540 00
JM033 012 1  0 30 15 3310   215 00
JM033 013 1  3  0  3 3010    42 00
JM033 014 1  2  0  2 3130   208 00
JM033 015 1  7  0  3 2480   198 00
JM033 053 2 030 075 0450 11723 03887 0123 03887 00123 00140 856 2 0800 01323020
JM033     3 672710 421503 00    035000   5 0042857 0029 0004   0 .07   0   0   0
JM033     4   0   0   0 .07   0 .27 .13 .40 .07   0   0   0   0   0   0   0   0
JM034 001 1  2  0  1 3540    34 00 156 000 0000049000 0 9
JM034 002 1  3  0  1  110    46 00
JM034 003 1  1 14  2  200    67 00
JM034 004 1  2  0  2  240    83 00
JM034 005 1  3  0  2  360   135 00
JM034 006 1  1  0  3  360   135 00
JM034 007 1  2 14  3  270   149 00
JM034 008 1  2  0  1  280   147 00
JM034 009 1  1  0  3  290   150 00
JM034 010 1  2  0  3  240   181 00
JM034 011 1  2  0  3  230   187 00
JM034 012 1  1  0  1  150   197 00
JM034 013 1  1  0  1  150   197 00
JM034 014 1  3  0  3   50   158 00
JM034 015 1  2 14  1   40   154 00
JM034 016 1  7  0  3   30   160 00
JM034 017 1  2  0  2   30   154 00
JM034 018 1  1  0  2   30   150 00
JM034 019 1  2  0  1  130   127 00
JM034 020 1  1  0  3  130   122 00
JM034 021 1  2 14  3  130   120 00
JM034 022 1  2  0  2  630   141 00
JM034 023 1  2  0  1  650   158 00
JM034 024 1  1  0  3  520   560 00
JM034 025 1  0  0  0  700   670 01
JM034 026 1  0 30 15 1100    57 00
JM034 027 1  1 14  1 1560    55 00
JM034 028 1  4 12  3 1590   179 00
JM034 029 1  2  0  2 3100    32 00
JM034 030 1  3  0  3 3050    61 00
JM034 031 1  1  0  1 3050    64 00
JM034 032 1  4 10  3 3060    64 00
JM034 033 1  1 14  1 3130    75 00
JM034 034 1  1  0  3 3160   100 00
JM034 035 1  2  0  1 3200   134 00
JM034 036 1  2  0  2 3160   141 00
JM034 037 1  7  0  1 3240   137 00
JM034 038 1  1  0  1 3240   171 00
JM034 039 1  3  0  3 3260   173 00
JM034 040 1  1  0  1 3280   166 00
JM034 041 1  1  0  3 3280   191 00
JM034 042 1  2  0  3 3300   202 00
JM034 043 1  2  0  1 3310   200 00
JM034 044 1  7  0  3 3050   145 00
JM034 045 1  1  0  2 3050   145 00
JM034 046 1  1  0  1 3320   120 00
JM034 047 1  2 14  2 3330   128 00
JM034 048 1  4 10  1 3380   135 00
JM034 049 1  2  0  1 2930   122 00
JM034 050 1  2  0  1 2790   111 00
JM034 051 1  2  0  2 2780   123 00
JM034 052 1  2  0  3 2530   106 00
JM034 053 1  0 30 15 2660   143 00
```

Table 14.1 - continued

JM034	054	1	3	0	3	2680	169	00
JM034	055	1	1	0	3	2630	176	00
JM034	056	1	2	0	1	2620	182	00
JM034	057	1	0	31	2	2650	189	00
JM034	058	1	1	0	3	2550	205	00
JM034	059	1	2	0	2	2550	205	00
JM034	060	1	7	0	2	2630	226	00
JM034	061	1	2	0	1	2630	229	00
JM034	062	1	2	0	2	2670	209	00
JM034	063	1	2	0	1	2730	194	00
JM034	064	1	3	0	1	2830	179	00
JM034	065	1	1	0	1	2850	166	00
JM034	066	1	3	0	1	2850	165	00
JM034	067	1	2	0	3	2850	208	00
JM034	068	1	2	0	6	2860	205	00
JM034	069	1	3	0	3	2890	210	00
JM034	070	1	2	0	2	2900	212	00
JM034	071	1	2	0	1	2910	216	00
JM034	072	1	1	0	3	2890	221	00
JM034	073	1	1	0	2	2910	222	00
JM034	074	1	3	0	2	2910	220	00
JM034	075	1	1	0	1	2930	219	00
JM034	076	1	1	0	1	2990	222	00
JM034	077	1	2	0	3	3000	213	00
JM034	078	1	2	0	2	3000	217	00
JM034	079	1	2	0	1	3000	211	00
JM034	080	1	2	0	3	3020	198	00
JM034	081	1	3	14	3	3030	196	00
JM034	082	1	2	0	3	3040	185	00
JM034	083	1	2	0	3	3000	245	00
JM034	084	1	2	0	1	3000	243	00
JM034	085	1	2	0	1	2910	242	00
JM034	086	1	2	0	3	2880	242	00
JM034	087	1	2	0	1	2880	243	00
JM034	088	1	2	0	2	2880	243	00
JM034	089	1	2	0	1	2870	230	00
JM034	090	1	2	14	1	2850	226	00
JM034	091	1	2	0	2	2860	234	00
JM034	092	1	2	0	3	2850	237	00
JM034	093	1	2	0	2	2850	252	00
JM034	094	1	1	0	3	2860	253	00
JM034	095	1	1	0	1	2880	271	00
JM034	096	1	2	14	3	2870	264	00
JM034	097	1	2	14	3	2850	260	00
JM034	098	1	2	0	2	2810	252	00
JM034	099	1	1	0	1	2860	325	00
JM034	100	1	2	0	1	2840	329	00
JM034	101	1	1	0	1	2800	54	00
JM034	102	1	2	0	2	2700	48	00
JM034	103	1	4	10	2	2650	46	00
JM034	104	1	4	10	2	2550	55	00
JM034	105	1	1	0	1	2550	55	00
JM034	106	1	2	0	2	2510	64	00
JM034	107	1	1	0	1	2230	79	00
JM034	108	1	2	0	2	2030	69	00
JM034	109	1	0	31	15	1980	104	00
JM034	110	1	4	10	1	1720	105	00
JM034	111	1	2	0	1	1630	107	00
JM034	112	1	2	0	3	1580	98	00
JM034	113	1	2	0	1	2350	119	00
JM034	114	1	2	0	1	2530	93	00
JM034	115	1	2	0	1	2840	201	00

Table 14.1 - continued

```
JM034 116 1  7  0  1 2700   276 00
JM034 117 1  2  0  1 2720   300 00
JM034 118 1  2  0  2 2780   312 00
JM034 119 1  2  0  2 2760   343 00
JM034 120 1  2  0  2 2750   369 00
JM034 121 1  2  0  2 2750   369 00
JM034 122 1  7  0  2 2750   376 00
JM034 123 1  2  0  2 2750   380 00
JM034 124 1  1  0  2 2760   373 00
JM034 125 1  2  0  2 2760   368 00
JM034 126 1  1  0  2 2830   334 00
JM034 127 1  1  0  3 2810   333 00
JM034 128 1  2  0  1 2810   293 00
JM034 129 1  1  0  1 2820   287 00
JM034 130 1  1  0  2 2870   289 00
JM034 131 1  1  0  1 2880   327 00
JM034 132 1  4 10  3 2860   520 00
JM034 133 1  7  0  2 2930   504 00
JM034 134 1  1  0  1 2930   466 00
JM034 135 1  1  0  2 2910   459 00
JM034 136 1  4 10  1 2940   423 00
JM034 137 1  7  0  2 2980   411 00
JM034 138 1  7  0  1 3000   431 00
JM034 139 1  0 30 15 3010   434 00
JM034 140 1  2  0  1 3010   431 00
JM034 141 1  4 10  1 3030   407 00
JM034 142 1  2  0  1 3070   390 00
JM034 143 1  2  0  2 3060   386 00
JM034 144 1  3  0  3 3060   382 00
JM034 145 1  4 10  2 3080   343 00
JM034 146 1  2  0  1 2950   319 00
JM034 147 1  0 31 15 2950   315 00
JM034 148 1  2  0  1 2930   250 00
JM034 149 1  2  0  1 3560    28 00
JM034 150 1  2  0  1 3560    28 00
JM034 151 1  1  0  1   50   132 00
JM034 152 1  0 31 15   70   148 00
JM034 153 1  1  0  1  150   158 00
JM034 154 1  7  0  1  300   173 00
JM034 155 1  0 30 15  320   188 00
JM034 156 1  1  0  1 1780   152 00
 2750 0328 0000 0000 0000 0000 101 000 000 156 000 000
JM034 053 2 030 065 0170 11713 02134 0143 02134 00143 00340 948 2 0800 01323020
JM034     3 672480 421538 01    049000   8 0318367 0038 0005    0    0    0 .06    0
JM034     4 .01 .07   0 .03 .03 .06 .24 .43 .07   0    0    0    0    0    0    0    0
JM035 001 1  2  0  3 2600    18 00 101 000 0000060000 0 1
JM035 002 1  7  0  3 2730    30 00
JM035 003 1  4 13  1 2740    30 00
JM035 004 1  4 15  1 2800    31 00
JM035 005 1  0 34  0 2800    31 00
JM035 006 1  0 34  0 2830    32 00
JM035 007 1  0 34  0 2830    32 00
JM035 008 1  0 34  0 2840    32 00
JM035 009 1  0 34  0 2840    32 00
JM035 010 1  2  0  1 3260    40 00
JM035 011 1  7  0  1 3150    72 00
JM035 012 1  7  0  1 3140    89 00
JM035 013 1  2  0  1 2960    76 00
JM035 014 1  2  0  2 2960    76 00
JM035 015 1  2  0  1 2970    73 00
JM035 016 1  7  0  2 2970    73 00
JM035 017 1  0 30 15 2970    61 00
```

Table 14.1 - continued

JM035	018	1	7	0	2	2970	61	00
JM035	019	1	7	0	1	3060	58	00
JM035	020	1	4	10	3	2780	83	00
JM035	021	1	7	0	2	2720	111	00
JM035	022	1	1	0	1	2620	111	00
JM035	023	1	7	0	3	2580	118	00
JM035	024	1	1	14	1	2630	132	00
JM035	025	1	4	13	3	2460	127	00
JM035	026	1	0	30	15	2450	131	00
JM035	027	1	1	14	3	2350	161	00
JM035	028	1	2	0	1	2270	152	00
JM035	029	1	0	30	15	2220	160	00
JM035	030	1	4	11	3	2050	98	00
JM035	031	1	7	0	1	2350	88	00
JM035	032	1	4	15	3	2550	468	00
JM035	033	1	3	0	1	2590	429	00
JM035	034	1	2	0	1	2600	418	00
JM035	035	1	2	0	1	2670	496	00
JM035	036	1	7	0	1	2710	540	00
JM035	037	1	1	0	3	2700	560	00
JM035	038	1	7	0	3	2650	690	00
JM035	039	1	7	0	3	2850	368	00
JM035	040	1	3	0	2	810	31	00
JM035	041	1	3	0	3	510	32	00
JM035	042	1	3	0	3	370	27	00
JM035	043	1	4	13	7	360	17	00
JM035	044	1	7	0	2	1500	147	00
JM035	045	1	7	0	3	1500	154	00
JM035	046	1	1	0	1	1480	139	00
JM035	047	1	4	13	1	1450	173	00
JM035	048	1	7	0	3	1380	148	00
JM035	049	1	2	0	1	1380	139	00
JM035	050	1	4	13	2	1370	136	00
JM035	051	1	1	0	1	1280	127	00
JM035	052	1	1	0	3	900	106	00
JM035	053	1	1	0	1	750	95	00
JM035	054	1	3	0	3	800	135	00
JM035	055	1	7	1	1	910	133	00
JM035	056	1	7	2	1	910	139	00
JM035	057	1	4	13	1	920	144	00
JM035	058	1	7	2	1	290	146	00
JM035	059	1	2	0	1	270	145	00
JM035	060	1	1	0	1	260	146	00
JM035	061	1	1	0	1	250	145	00
JM035	062	1	7	0	2	250	132	00
JM035	063	1	1	0	1	250	128	00
JM035	064	1	1	0	1	230	107	00
JM035	065	1	4	13	4	30	85	00
JM035	066	1	3	14	3	460	247	00
JM035	067	1	2	0	3	340	240	00
JM035	068	1	2	0	3	730	247	00
JM035	069	1	7	0	3	800	241	00
JM035	070	1	1	0	1	870	242	00
JM035	071	1	1	0	2	900	248	00
JM035	072	1	1	0	2	830	275	00
JM035	073	1	2	0	2	830	318	00
JM035	074	1	4	13	3	730	371	00
JM035	075	1	4	11	3	760	377	00
JM035	076	1	3	0	6	750	392	00
JM035	077	1	7	0	2	770	411	00
JM035	078	1	1	0	3	780	398	00
JM035	079	1	0	30	15	790	404	00

Table 14.1 - continued

```
JM035 080 1  2  0  1  790  404 00
JM035 081 1  7  0  1  830  397 00
JM035 082 1  1  0  1  830  396 00
JM035 083 1  7  2  1  830  373 00
JM035 084 1  7  0  2  900  406 00
JM035 085 1  7  0  3  910  395 00
JM035 086 1  1  0  2  910  375 00
JM035 087 1  1  0  3  910  375 00
JM035 088 1  7  0  3  910  375 00
JM035 089 1  1  0  6  950  380 00
JM035 090 1  1  0  1  950  380 00
JM035 091 1  7  0  1  950  350 00
JM035 092 1  1  0  2  950  350 00
JM035 093 1  3  0  1  950  350 00
JM035 094 1  1  0  1  950  350 00
JM035 095 1  4 10  6  950  356 00
JM035 096 1  1  0  1 1000  351 00
JM035 097 1  7  0  1 1000  303 00
JM035 098 1  2  0  2 1000  303 00
JM035 099 1  1  0  3 1040  363 00
JM035 100 1  1  0  2 1040  363 00
JM035 101 1  0  0  0  920  970 01
JM035 053 2 030 065 0050 11723 03049 0153 03049 00153 00280 908 2 0800 01323020
JM035     3 672360 421533 01     060000  12 0168333 0038 0005 .01 .03 .08 .02 .02
JM035     4   0 .03 .02 .04   0 .24 .24 .15 .07   0   0   0   0   0   0   0 .05
JM036 001 1  1  0  2 1590  177 00  48 000 0000004000 0 1
JM036 002 1  2  0  1 1600  162 00
JM036 003 1  1  0  1 1650  155 00
JM036 004 1  7  0  2 1540  144 00
JM036 005 1  3  0  1 1730  145 00
JM036 006 1  2  0  1 1500   40 00
JM036 007 1  0 32 15 1240   52 00
JM036 008 1  2  0  1 1240   52 00
JM036 009 1  3  0  3 1600   15 00
JM036 010 1  1  0  1 1660   15 00
JM036 011 1  7  0  1 1990   40 00
JM036 012 1  3  0  1 2090   73 00
JM036 013 1  1  0  7 2140   74 00
JM036 014 1  7  0  2 2170   79 00
JM036 015 1  3  0  3 1940  182 00
JM036 016 1  2  0  1 2240  115 00
JM036 017 1  2  0  1 2480  118 00
JM036 018 1  2  0  1 2490  139 00
JM036 019 1  1  0  1 2550  119 00
JM036 020 1  2 13  1 2490  100 00
JM036 021 1  7  0  1 2500   59 00
JM036 022 1  1  0  1 2620   56 00
JM036 023 1  2  0  2 2710   34 00
JM036 024 1  2 14  1 2800   27 00
JM036 025 1  2  0  1 2850   45 00
JM036 026 1  2  0  1 2980   33 00
JM036 027 1  2 14  1 2850   80 00
JM036 028 1  1  0  1 2940  140 00
JM036 029 1  7  0  1 3160  148 00
JM036 030 1  1  0  1 3170  132 00
JM036 031 1  2 14  1 3160  121 00
JM036 032 1  1 14  1 3130   90 00
JM036 033 1  7  0  1 3210  148 00
JM036 034 1  1  0  1 3220  145 00
JM036 035 1  7  0  1 3250  144 00
JM036 036 1  7  0  1 3280  153 00
JM036 037 1  2  0  2 3220  130 00
```

Table 14.1 - continued

```
JM036 038 1  7  0  1 3220  130 00
JM036 039 1  7  3  1 3390  185 00
JM036 040 1  7  1  1 3370   94 00
JM036 041 1  2  0  1 3240   48 00
JM036 042 1  0 34  0 3410   31 00
JM036 043 1  1  0  1 3550   31 00
JM036 044 1  2  0  1  160   78 00
JM036 045 1  2  0  1  220   62 00
JM036 046 1  2  0  3  520   94 00
JM036 047 1  1  0  1  670   44 00
JM036 048 1  1  0  2  840   48 00
JM036 053 2 030 055 0270 11692 00381 0015 02744 00107 00280 910 2 0800 01323020
JM036     3 672140 421537 00     004000    9 0120000 0029 0006 .02    0 .04    0    0
JM036     4    0 .08    0     0    0 .19 .25 .29 .08    0    0    0    0    0 .02    0 .02
JM038 001 1  0 30 15 3120   47 00  93 000 0000150000 0 9
JM038 002 1  7  0  1 3120   86 00
JM038 003 1  0 30 15 3300   62 00
JM038 004 1  0 30 15 3300   62 00
JM038 005 1  7  1  1   30   56 00
JM038 006 1  2 14  3  150  105 00
JM038 007 1  2  0  2  220  112 00
JM038 008 1  7  0  1   90  128 00
JM038 009 1  1 14  3   10  252 00
JM038 010 1  7  0  1 3580  130 00
JM038 011 1  3  0  3  190  348 00
JM038 012 1  1 10  1  120  190 00
JM038 013 1  7  0  1  190  163 00
JM038 014 1  0 32 15  260  179 00
JM038 015 1  7  2 14  240  168 00
JM038 016 1  2  0  1  300  163 00
JM038 017 1  0 32 15  320  165 00
JM038 018 1  0 32 15  350  167 00
JM038 019 1  1 14  1  520   56 00
JM038 020 1  0 30 15  490  116 00
JM038 021 1  7  0  1  460  140 00
JM038 022 1  0 30 15  580   46 00
JM038 023 1  0  0  0  690   86 01
JM038 024 1  0 30 15  640  100 00
JM038 025 1  4 13  1  490  439 00
JM038 026 1  0 30 15  500  394 00
JM038 027 1  7  0  1  600  337 00
JM038 028 1  7  0  3  670  422 00
JM038 029 1  0 30 15  700  467 00
JM038 030 1  3  0  1  730  510 00
JM038 031 1  3  0  4    0    0 00
JM038 032 1  0 30 15  730  375 00
JM038 033 1  0 30 15  730  344 00
JM038 034 1  1  0  1  700  310 00
JM038 035 1  7  0  1  670  270 00
JM038 036 1  1  0  1  700  150 00
JM038 037 1  2  0  1  750  164 00
JM038 038 1  0 32 15  760  181 00
JM038 039 1  2  0  3  790  191 00
JM038 040 1  2  0  2  810  187 00
JM038 041 1  4 13  1  870  317 00
JM038 042 1  3 14  1  820  530 00
JM038 043 1  2  0  1  820  570 00
JM038 044 1  3  0  3 1050  485 00
JM038 045 1  0  0 15 1650   38 01
JM038 046 1  2  0  1 1540   58 00
JM038 047 1  0 30 15 1640  114 00
JM038 048 1  2  0  1 1400   34 00
```

Table 14.1 - continued

```
JM038 049 1  7  0  2 1150   92 00
JM038 050 1  2  0  1 1150  102 00
JM038 051 1  1  0  1 1160  123 00
JM038 052 1  0 31 15 1200  155 00
JM038 053 1  0 30 15 1110  173 00
JM038 054 1  0 31 15 1140  198 00
JM038 055 1  2  0  1 1140  223 00
JM038 056 1  0 30 15 1160  221 00
JM038 057 1  0 30 15 1180  219 00
JM038 058 1  0 31 15 1200  196 00
JM038 059 1  2  0  1 1240  223 00
JM038 060 1  0 30 15 1260  241 00
JM038 061 1  0 30 15 1230  261 00
JM038 062 1  0 31 15 1370  227 00
JM038 063 1  7  0  1 1400  255 00
JM038 064 1  0 30 15 1250  244 00
JM038 065 1  2  0  1 1400  389 00
JM038 066 1  0 30 15 1400  396 00
JM038 067 1  0 30 15 1400  406 00
JM038 068 1  7  0  2 1520  393 00
JM038 069 1  0 30 15 1520  387 00
JM038 070 1  0 31 15 1500  376 00
JM038 071 1  0  0 15 1470  363 01
JM038 072 1  0  0 15  370  406 01
JM038 073 1  7  0  1  320  256 00
JM038 074 1  1  0  1  300  260 00
JM038 075 1  0 30 15  300  260 00
JM038 076 1  2  0  1  200  275 00
JM038 077 1  7  0  3  200  235 00
JM038 078 1  7  0  1 3540  252 00
JM038 079 1  2  0  1 3510  189 00
JM038 080 1  1  0  1 3530  174 00
JM038 081 1  1  0  1 3470  132 00
JM038 082 1  7  0  1 3440  117 00
JM038 083 1  2  0  3 3100  409 00
JM038 084 1  2  0  1 3080  133 00
JM038 085 1  0 30 15 2740  102 00
JM038 086 1  4 10  3 2740  102 00
JM038 087 1  1  0  1 2850   46 00
JM038 088 1  2  0  3 1760   13 00
JM038 089 1  0  0 15 1680   47 01
JM038 090 1  2  0  1 1890   76 00
JM038 091 1  2  0  2 1940   88 00
JM038 092 1  0  0 15  230   54 01
JM038 093 1  7  0  3  230   54 00
 1220 1500 0000 0000 0000 0000 048 000 000 093 000 000
JM038 053 2 040 060 0500 11799 02805 0076 15244 00214 00260 836 3 0800 01323020
JM038     3 670720 421525 06    150000  11 0060000 0019 0003 .01 .01 .02 .02   0
JM038     4   0 .04   0 .24 .05 .17 .08 .20 .04   0   0   0   0   0 .04   0   0
JM039 001 1  4 13  1 2140  255 00  12 000 025000 0 1
JM039 002 1  2 14  3 2720   82 00
JM039 003 1  4 13  1 3390   79 00
JM039 004 1  4 13  1 3390  124 00
JM039 005 1  2 14  1  480  156 00
JM039 006 1  4 13  2  590   69 00
JM039 007 1  3  0  2  610   69 00
JM039 008 1  1  0  1 1000   44 00
JM039 009 1  0  0 15  550  162 09
JM039 010 1  0  0 15  560  189 09
JM039 011 1  0  0 15  640  209 09
JM039 012 1  0  0 15  700  183 09
JM039 053 2 000 040 0810 11826 00300 0030 04000 00091 00000 630 2 0800 01323020
```

Table 14.1 - continued

```
JM039       3 665440 421503 00     025000    3 0036000 0029 0003    0    0 .33    0    0
JM039       4    0 .17    0    0    0    0 .08    0 .08    0    0    0    0    0    0    0    0
JM043 001 1   4 11   3 1590   163 00  34 000 0001000000 0 1
JM043 002 1   1 14   2  560   138 00
JM043 003 1   2 14   3  530   220 00
JM043 004 1   1  0   1 2560    78 00
JM043 005 1   3  0   1 2510    87 00
JM043 006 1   3 14   1 2200    88 00
JM043 007 1   3 14   1 2050    67 00
JM043 008 1   1 14   3 2070    95 00
JM043 009 1   3 14   5 1950   164 00
JM043 010 1   2  0   3   50   164 00
JM043 011 1   4 11   3   30   165 00
JM043 012 1   3  0   5   30   165 00
JM043 013 1   3 14   1 3520   110 00
JM043 014 1   3 14   2 3580   105 00
JM043 015 1   3 14   1 3580   105 00
JM043 016 1   4  0   3 3580    66 00
JM043 017 1   3 14   2  190    43 00
JM043 018 1   2 14   2  230    37 00
JM043 019 1   3 14   1  250    38 00
JM043 020 1   2 14   1  270    38 00
JM043 021 1   1 14   1  900    31 00
JM043 022 1   2  0   3 3500   166 00
JM043 023 1   2  0   1 3460   160 00
JM043 024 1   2  0   1 3470   149 00
JM043 025 1   1  0   1 3440   168 00
JM043 026 1   2  0   1   30   251 00
JM043 027 1   2 14   5 3540   214 00
JM043 028 1   2  0   5 3450   213 00
JM043 029 1   2  0   1 3450   206 00
JM043 030 1   2  0   3 3440   202 00
JM043 031 1   2  0   1 3410   177 00
JM043 032 1   7  0   1 3410   199 00
JM043 033 1   2  0   1 3390   200 00
JM043 034 1   3 14   5  800    72 00
JM043 031 2 015 060 0120 11765 00610 0061 00610 00061 00130 578 2 1800 22222222
JM043       3 662390 421435 00     100000    6 0033000 0019 0022    0    0    0    0 .06
JM043       4    0 .47    0    0    0 .03 .06 .29 .06    0    0 .03    0    0    0    0    0
JM051 001 1   4 13   8 3370    40 00  91 000 0000035750 0 1
JM051 002 1   4 14   1 3360    42 00
JM051 003 1   4 13   5 3260    39 00
JM051 004 1   4 14   1   25    60 00
JM051 005 1   4 13  12   20    90 00
JM051 006 1   2  0   5 3350    59 00
JM051 007 1   4 13   3 3300    64 00
JM051 008 1   3  0   5 3350    84 00
JM051 009 1   3  0   5  620    63 00
JM051 010 1   2  0   2  710   103 00
JM051 011 1   1  0   1  405   130 00
JM051 012 1   4 14   1  350   328 00
JM051 013 1   7  0   1  360   334 00
JM051 014 1   3  0   5  380   352 00
JM051 015 1   3  0   3  270   372 00
JM051 016 1   7  0   2  270   302 00
JM051 017 1   3  0   1  230   300 00
JM051 018 1   4 14   5  240   315 00
JM051 019 1   4 13   1  240   316 00
JM051 020 1   3  0   5  180   214 00
JM051 021 1   4 14   1  270   472 00
JM051 022 1   2  0   2  200   499 00
JM051 023 1   3  0   2  110   319 00
```

Table 14.1 - continued

JM051	024	1	4	13	4	140	488	00
JM051	025	1	3	0	4	110	237	00
JM051	026	1	2	0	5	3520	178	00
JM051	027	1	3	0	2	3550	219	00
JM051	028	1	3	0	1	3510	229	00
JM051	029	1	3	0	2	3440	152	00
JM051	030	1	7	0	1	3445	156	00
JM051	031	1	2	0	1	3420	226	00
JM051	032	1	2	0	2	3415	225	00
JM051	033	1	1	0	3	3425	246	00
JM051	034	1	2	0	1	3470	286	00
JM051	035	1	7	0	5	3520	325	00
JM051	036	1	6	0	3	3500	318	00
JM051	037	1	7	2	14	3575	325	00
JM051	038	1	3	0	1	20	338	00
JM051	039	1	3	0	1	20	385	00
JM051	040	1	7	0	5	90	394	00
JM051	041	1	7	0	5	70	414	00
JM051	042	1	4	13	5	60	434	00
JM051	043	1	1	0	5	20	469	00
JM051	044	1	3	0	5	3450	387	00
JM051	045	1	3	0	1	3400	424	00
JM051	046	1	7	0	2	3395	521	00
JM051	047	1	4	11	5	3395	528	00
JM051	048	1	2	0	5	3400	530	00
JM051	049	1	7	0	1	3300	474	00
JM051	050	1	2	0	1	3315	540	00
JM051	051	1	4	14	2	3335	436	00
JM051	052	1	2	0	1	3210	377	00
JM051	053	1	3	0	1	3265	444	00
JM051	054	1	2	0	2	3250	469	00
JM051	055	1	4	14	4	3250	482	00
JM051	056	1	7	0	1	3240	490	00
JM051	057	1	3	0	2	3235	469	00
JM051	058	1	3	0	1	3090	97	00
JM051	059	1	4	14	1	3020	147	00
JM051	060	1	3	0	1	2880	289	00
JM051	061	1	3	0	1	2875	300	00
JM051	062	1	4	14	3	2890	296	00
JM051	063	1	7	0	3	2855	314	00
JM051	064	1	4	14	1	2845	318	00
JM051	065	1	7	0	1	2855	322	00
JM051	066	1	3	0	1	2850	327	00
JM051	067	1	7	0	1	2850	335	00
JM051	068	1	2	0	1	2840	335	00
JM051	069	1	2	0	1	2860	347	00
JM051	070	1	3	0	1	2850	344	00
JM051	071	1	7	0	5	2825	267	00
JM051	072	1	4	14	1	2875	132	00
JM051	073	1	4	14	1	2760	149	00
JM051	074	1	4	14	1	2745	179	00
JM051	075	1	2	0	5	2770	192	00
JM051	076	1	7	0	5	2705	187	00
JM051	077	1	2	0	2	2720	200	00
JM051	078	1	4	14	1	2780	248	00
JM051	079	1	4	14	1	2760	248	00
JM051	080	1	4	15	1	2770	248	00
JM051	081	1	7	1	14	2710	259	00
JM051	082	1	2	0	2	2680	280	00
JM051	083	1	3	0	1	2690	314	00
JM051	084	1	7	0	1	2700	345	00
JM051	085	1	3	0	1	2720	346	00

Table 14.1 - continued

```
JM051 086 1  1  0  6 2720  346 00
JM051 087 1  3  0  1 2740  298 00
JM051 088 1  4 13  1 2740  298 00
JM051 089 1  4 14  5 2620  256 00
JM051 090 1  3  0  1 2600  275 00
JM051 091 1  4 14  1 2600  150 00
JM051 006 2 000 015 1100 11765 08534 0167 08534 00183 01000 999 1 0800 23031000
JM051     3 673260 421692 00     016000  10 0562500 0019 0012 .01 .01 .09   0 .01
JM051     4   0 .19 .01   0   0 .16 .04 .18 .29   0 .01   0   0   0   0   0   0
JM052 001 1  4 14  2 2960   42 00  24 000 0000009610 0 1
JM052 002 1  1  0  1 3080   53 00
JM052 003 1  2  0  8 3130   84 00
JM052 004 1  2  0  3 3270   82 00
JM052 005 1  4 14  1 3280   94 00
JM052 006 1  3 14  4 3240  140 00
JM052 007 1  4 15  1 3230  140 00
JM052 008 1  3  0  3 2730  100 00
JM052 009 1  3  0  4 2600  113 00
JM052 010 1  3  0  4 2440  150 00
JM052 011 1  3  0  4 2440  150 00
JM052 012 1  7  4  1 2350  232 00
JM052 013 1  1  0  3 2200  140 00
JM052 014 1  3  0  3 2240  217 00
JM052 015 1  3  0  2 1960   54 00
JM052 016 1  3 14 12 1720  114 00
JM052 017 1  3  0  3 1900  196 00
JM052 018 1  3 14  3 2080  352 00
JM052 019 1  7  2  7 2130  291 00
JM052 020 1  2 14  6 2060  372 00
JM052 021 1  7  0  6 1260  140 00
JM052 022 1  3  0  1 2730  313 00
JM052 023 1  4 14  6 2500  350 00
JM052 024 1  4 13  5 2530  670 00
JM052 006 2 002 010 1280 11742 04572 0114 08839 00160 00900 999 1 0800 23031000
JM052     3 673240 421704 00     009610   8 0249739 0019 0013   0 .04 .04   0   0
JM052     4   0 .29 .04   0   0 .04 .08 .08 .33   0   0   0 .04   0   0   0   0
JM053 001 1  7  0  5  280  100 00  27 000 0000028600 0 1
JM053 002 1  1  0  1  570  130 00
JM053 003 1  3 14  1  560  132 00
JM053 004 1  1  0  2  560  134 00
JM053 005 1  1 13  1  750  120 00
JM053 006 1  2 14  1  900   24 00
JM053 007 1  7  0  1 1160  195 00
JM053 008 1  7  0  2 1190  284 00
JM053 009 1  7  0  1 3380  215 00
JM053 010 1  2 14  1 3400  219 00
JM053 011 1  3 14  1 3550  166 00
JM053 012 1  7  1  1  180  165 00
JM053 013 1  7  0  3   50  296 00
JM053 014 1  1  0  1  110  331 00
JM053 015 1  3 14  1  130  345 00
JM053 016 1  7  0  1  140  351 00
JM053 017 1  1 14  1  160  358 00
JM053 018 1  1 14  1  220  367 00
JM053 019 1  2 14  2  330  414 00
JM053 020 1  7  0  1  400  476 00
JM053 021 1  7  0  2  470  416 00
JM053 022 1  1 14  1  580  460 00
JM053 023 1  7  1  1  600  489 00
JM053 024 1  3 14  1  640  504 00
JM053 025 1  2 15  1  650  608 00
JM053 026 1  3 14  5  960   22 00
```

Table 14.1 - continued

```
JM053 027 1   1   0   2 2440   114 00
JM053 006 2 075 050 2250 11842 04877 0168 13106 00260 00340 960 2 0800 23031000
JM053       3 673420 421761 00      028600    5 0094405 0029 0013 .07    0 .04    0    0
JM053       4    0 .41 .04    0    0 .30 .15    0    0    0    0    0    0    0    0    0    0
JM055 001 1   2   0   3 3390   117 00  43 000 0000028800 0 1
JM055 002 1   1  14   1 3070   411 00
JM055 003 1   2  14   2 3060   345 00
JM055 004 1   2   0   6 3110   363 00
JM055 005 1   2   0   6 3110   371 00
JM055 006 1   2  14   5 3080   501 00
JM055 007 1   2  14   1 3210   337 00
JM055 008 1   2  15   1 3370   289 00
JM055 009 1   2   0   3 3400   302 00
JM055 010 1   2  14   1 3380   204 00
JM055 011 1   3  12   3   90   327 00
JM055 012 1   2  14   1  110   215 00
JM055 013 1   1   0   1  210   152 00
JM055 014 1   3  14   1  210   152 00
JM055 015 1   7   0   1  230   299 00
JM055 016 1   7   0   4  460   349 00
JM055 017 1   1  16   7  540   327 00
JM055 018 1   7   0   1  540   261 00
JM055 019 1   2  14   1  650   335 00
JM055 020 1   2  14   1  650   452 00
JM055 021 1   1  14   1  660   452 00
JM055 022 1   1  14   1  700   299 00
JM055 023 1   1  13   1  730   319 00
JM055 024 1   7   4   1  760   340 00
JM055 025 1   1  14   1  760   340 00
JM055 026 1   1   0   1  920   165 00
JM055 027 1   2   0   1  970   219 00
JM055 028 1   3  14   1  860   340 00
JM055 029 1   1  14   1  820   404 00
JM055 030 1   1  14   1  810   413 00
JM055 031 1   7   0   1  820   444 00
JM055 032 1   2  14   1  830   451 00
JM055 033 1   7   0   3  830   478 00
JM055 034 1   2  14   1  870   429 00
JM055 035 1   7   0   2  920   318 00
JM055 036 1   2   0   3 1050   312 00
JM055 037 1   1  14   1 1080   413 00
JM055 038 1   2  14   1 1210   444 00
JM055 039 1   1   0   1 2310   208 00
JM055 040 1   1  14   1 2340   397 00
JM055 041 1   2  14   3 2400   470 00
JM055 042 1   1  14   1 2460   531 00
JM055 043 1   1  14   1 2460   531 00
JM055 006 2 080 040 2650 11826 06670 0152 21950 00244 00320 908 2 0800 23031000
JM055       3 673870 421754 00      006080    8 0707236 0029 0013    0    0 .02    0    0
JM055       4 .02 .53 .02    0    0 .14 .07 .14    0    0    0    0 .02    0    0    0    0
JM057 001 1   1  14   1   10    36 00  27 000 0000010560 0 1
JM057 002 1   1  14   1  220   140 00
JM057 003 1   1   0   3   30   210 00
JM057 004 1   1   0   1  140   227 00
JM057 005 1   1   0   3  190   220 00
JM057 006 1   0  13   1  230   240 00
JM057 007 1   1   0   6  320   264 00
JM057 008 1   7   1   1  410   265 00
JM057 009 1   7   0   1  220   252 00
JM057 010 1   1   0   6   40   270 00
JM057 011 1   7   0   6 3510   218 00
JM057 012 1   4  13   1 3550   248 00
```

Table 14.1 - continued

```
JM057 013 1  7  0  3   90   310 00
JM057 014 1  1  0  1  130   313 00
JM057 015 1  1  0  6   70   318 00
JM057 016 1  1  0  1  190   294 00
JM057 017 1  7  0  2  280   276 00
JM057 018 1  1  0  1  310   259 00
JM057 019 1  4 13  1  230   442 00
JM057 020 1  1  0  1  230   458 00
JM057 021 1  1  0  6  300   570 00
JM057 022 1  1  0  1  130   396 00
JM057 023 1  7  0  1  130   406 00
JM057 024 1  2  0  1   60   363 00
JM057 025 1  7  0  1   80   371 00
JM057 026 1  4 13  1   60   491 00
JM057 027 1  7  0  1  150   600 00
JM057 006 2 010 020 0400 11765 01143 0076 10363 00213 00980 999 1 0800 23031000
JM057     3 673970 421671 00    010560   5 0255681 0048 0015 .04   0 .11   0   0
JM057     4   0 .07   0   0   0 .26 .44 .04   0   0   0   0   0   0   0   0
JM058 001 1  7  0  1 3580    78 00  21 000 0000028800 0 1
JM058 002 1  1  0  2 3310   288 00
JM058 003 1  1  0  3 3230   302 00
JM058 004 1  2  0  1 3210   266 00
JM058 005 1  1  0  1 3210   269 00
JM058 006 1  2  0  1 3000   212 00
JM058 007 1  7  0  1 3010   214 00
JM058 008 1  2 14  1 3100   130 00
JM058 009 1  2  0  3 2960    48 00
JM058 010 1  2 14  3 2810    48 00
JM058 011 1  0 32 15 2570    34 00
JM058 012 1  3  0  6 2580   142 00
JM058 013 1  4 13  1 2600   142 00
JM058 014 1  2  0  1 2710   315 00
JM058 015 1  7  0  2 2580   274 00
JM058 016 1  2  0  2 2540   265 00
JM058 017 1  3  0  2 2140   321 00
JM058 018 1  3  0  3 2120   284 00
JM058 019 1  2  0  1 2120   289 00
JM058 020 1  2 14  1 1950   287 00
JM058 021 1  4 13  1 1940   290 00
JM058 006 2 000 010 0300 11735 02545 0015 10668 00183 01020 999 1 0800 23031000
JM058     3 674020 421668 00    028800   6 0072916 0038 0015   0   0 .10   0   0
JM058     4   0 .14   0   0   0 .14 .14 .29 .14   0   0   0   0   0 .05   0   0
JM059 001 1  2 14  1 3240    11 00  76 000 0000023040 0 1
JM059 002 1  3 14  1  480    51 00
JM059 003 1  3 14  1  390    63 00
JM059 004 1  3  0  1 3560    99 00
JM059 005 1  3 14  1   80    98 00
JM059 006 1  3  0  5   90   124 00
JM059 007 1  3  0  1  400    75 00
JM059 008 1  3 14  5 1010    46 00
JM059 009 1  2  0  1 1010    73 00
JM059 010 1  1 14  1 1200    53 00
JM059 011 1  3  0  1 1160    75 00
JM059 012 1  2 14  1 1090    84 00
JM059 013 1  7  0  3 1030   139 00
JM059 014 1  7  0  6  920   140 00
JM059 015 1  1 14  1  810   109 00
JM059 016 1  2  0 12  760   132 00
JM059 017 1  3  0  1  710   137 00
JM059 018 1  1 14  3  680   143 00
JM059 019 1  3 14  1  830   186 00
JM059 020 1  2 14  1  750   223 00
```

Table 14.1 - continued

```
JM059 021 1  2 14  1  840  248 00
JM059 022 1  7  4  1  680  245 00
JM059 023 1  2 14  1  680  245 00
JM059 024 1  7  0  1  490  136 00
JM059 025 1  7  0  2  520  156 00
JM059 026 1  7  2  1  520  195 00
JM059 027 1  1  0  1  530  210 00
JM059 028 1  3  0  1  530  210 00
JM059 029 1  7  0  3  560  224 00
JM059 030 1  7  0  3  410  155 00
JM059 031 1  3 14  1  260  191 00
JM059 032 1  2  0  1  250  257 00
JM059 033 1  1  0 16 3580  208 00
JM059 034 1  4 14  1    0  178 00
JM059 035 1  3  0  2   90  249 00
JM059 036 1  3 14  1  440  267 00
JM059 037 1  1  0  1  620  249 00
JM059 038 1  3 14  1  610  268 00
JM059 039 1  1 14  1  920  232 00
JM059 040 1  1  0  1  880  262 00
JM059 041 1  2  0  1  880  340 00
JM059 042 1  2 14  7  870  346 00
JM059 043 1  7  0  1  870  346 00
JM059 044 1  2  0  1  920  336 00
JM059 045 1  2 14  1  940  325 00
JM059 046 1  2 14  1  940  325 00
JM059 047 1  2 14  1  950  331 00
JM059 048 1  3 14  1 1090  318 00
JM059 049 1  1  0  1 1080  265 00
JM059 050 1  1 14  1 1040  237 00
JM059 051 1  1 14  1 1050  190 00
JM059 052 1  1  0  1 1010  176 00
JM059 053 1  1 14  3 1100  248 00
JM059 054 1  7  0  5 1040  379 00
JM059 055 1  2  0  1 1140  359 00
JM059 056 1  2 14  1 1150  355 00
JM059 057 1  2 14  1 1160  224 00
JM059 058 1  1 14  1 1150  206 00
JM059 059 1  1 14  1 1180  204 00
JM059 060 1  1 14  1 1350   97 00
JM059 061 1  3 14  1 1420  136 00
JM059 062 1  3 14  3 1420  130 00
JM059 063 1  3 14  1 1400  214 00
JM059 064 1  3  0  1 1430  217 00
JM059 065 1  7  0  1 1430  251 00
JM059 066 1  2  0  1 1400  256 00
JM059 067 1  3 14  1 1400  279 00
JM059 068 1  1 14  6 1410  295 00
JM059 069 1  2 14  1 1410  349 00
JM059 070 1  2 14  1 1370  346 00
JM059 071 1  3 14  1 1450  385 00
JM059 072 1  2 14  1 1380  238 00
JM059 073 1  3  0  1 1350  233 00
JM059 074 1  3 14  2 1610  322 00
JM059 075 1  2 14  1 1620  280 00
JM059 076 1  7  0  1 1240  269 00
JM059 006 2 030 015 1930 11735 08000 0107 18000 00198 01070 999 1 0800 23031000
JM059     3 674120 421654 00    023040    6 0329861 0038 0017    0 .01    0    0    0
JM059     4    0 .55    0    0    0 .13 .08 .09 .12    0    0    0 .01    0    0    0    0
JM060 001 1  7  0  1 1370  183 00  48 000 0000014160 0 1
JM060 002 1  2  0  1 1350  217 00
JM060 003 1  3 14  1 1490  239 00
```

Table 14.1 - continued

```
JM060 004 1  2 14  1 1480   174 00
JM060 005 1  3  0  6 1500   230 00
JM060 006 1  3  0  3 1480   328 00
JM060 007 1  2  0  1 1470   328 00
JM060 008 1  1 14  1 1510   332 00
JM060 009 1  7  0  1 1520   344 00
JM060 010 1  7  0  6 1510   343 00
JM060 011 1  7  0  1 1530   344 00
JM060 012 1  1  0  1 1550   245 00
JM060 013 1  7  0  1 1540   296 00
JM060 014 1  7  2  2 1570   338 00
JM060 015 1  3  0  1 1580   264 00
JM060 016 1  2 14  2 1600   291 00
JM060 017 1  2  0  3 1600   228 00
JM060 018 1  1 14  1 1610   183 00
JM060 019 1  7  0  2 1620   179 00
JM060 020 1  7  2  2 1640   186 00
JM060 021 1  2 14  1 1660   159 00
JM060 022 1  3 14  1 1650    65 00
JM060 023 1  3 14  1 1660    66 00
JM060 024 1  1  0  9 1700    67 00
JM060 025 1  7  4  1 1780    72 00
JM060 026 1  7  0  2 1800    91 00
JM060 027 1  7  0  1 1700   144 00
JM060 028 1  3  0  1 1700   143 00
JM060 029 1  4 17  1 1700   143 00
JM060 030 1  3 14  2 1750   158 00
JM060 031 1  7  0  1 1740   235 00
JM060 032 1  3  0  1 1780   256 00
JM060 033 1  2 14  1 1790   135 00
JM060 034 1  3 14  1 1820   177 00
JM060 035 1  7  2  1 1830   186 00
JM060 036 1  4 13  1 1920   210 00
JM060 037 1  7  0  3 1930   173 00
JM060 038 1  7  0  1 1950    96 00
JM060 039 1  3 14  1 1950    96 00
JM060 040 1  3 14  1 2050   103 00
JM060 041 1  3 14  1 1960   181 00
JM060 042 1  3 14  1 1960   207 00
JM060 043 1  2 14  1 1980   206 00
JM060 044 1  0  0  0 2040   282 01
JM060 045 1  2  0  1 2110   122 00
JM060 046 1  7  0  1 1250   206 00
JM060 047 1  1 14  1 3050   104 00
JM060 048 1  3  0  2 3030   110 00
JM060 100 2 040 040 3600 11720 05638 0138 04115 00168 01800 999 1 0800 23031000
JM060     3 674180 421572 01     014157   8 0339054 0010 0012   0 .06 .02   0   0
JM060     4   0 .35   0    0    0 .25 .04 .08 .13   0   0   0 .02 .02   0   0   0
JM061 001 1  1 14  1 2250    98 00  47 000 0000014400 0 1
JM061 002 1  4 11  3 2220   145 00
JM061 003 1  2  0  5 1240    46 00
JM061 004 1  3 14  2 1220    83 00
JM061 005 1  3  0  2 1300   146 00
JM061 006 1  3  0  3 1440   184 00
JM061 007 1  4 13  1 1340   223 00
JM061 008 1  2 14  1 1040   152 00
JM061 009 1  2 14  2  960   139 00
JM061 010 1  1 14  2  920   312 00
JM061 011 1  7  0  1  850   340 00
JM061 012 1  2 15  1  860   182 00
JM061 013 1  2 14  2  810   219 00
JM061 014 1  2  0  1  790   276 00
```

Table 14.1 - continued

```
JM061 015 1  1 14  1  780  990 00
JM061 016 1  7  0  1  780  101 00
JM061 017 1  7  0  3  740  113 00
JM061 018 1  7  0  1  710  259 00
JM061 019 1  1 14  1  660  373 00
JM061 020 1  3 14  1  660  180 00
JM061 021 1  2 13  1  540  282 00
JM061 022 1  2 14  1  550  221 00
JM061 023 1  1 14  1  550  114 00
JM061 024 1  1 14  1  500   87 00
JM061 025 1  7  0  1  500   92 00
JM061 026 1  3 14  1  430   86 00
JM061 027 1  2 14  1  410  117 00
JM061 028 1  3  0  8  460  111 00
JM061 029 1  7  4  1  390  169 00
JM061 030 1  1 14  1  330  200 00
JM061 031 1  3 14  1  280  179 00
JM061 032 1  7  0  3  280  183 00
JM061 033 1  7  0  1  280  190 00
JM061 034 1  2  0  3  380  306 00
JM061 035 1  7  2  7  190  222 00
JM061 036 1  7  0  1  300  329 00
JMC61 037 1  1 13  1  260  321 00
JM061 038 1  2  0  1  280  367 00
JM061 039 1  2 13  1  170  293 00
JM061 040 1  3 14  1  170  258 00
JM061 041 1  2  0  1  160  213 00
JM061 042 1  1 14  1  130  191 00
JM061 043 1  7  0  1  120  277 00
JM061 044 1  7  0  1  120  317 00
JM061 045 1  2 14  1   50  336 00
JM061 046 1  2  0  1    0  166 00
JM061 047 1  2 13  2 3490  130 00
JM061 006 2 010 015 0940 11689 00667 0015 22667 00152 00800 999 1 0800 23031000
JM061     3 674760 421661 00    014400   8 0326388 0019 0015   0 .02 .11   0 .02
JM061     4   0 .40 .02   0   0 .21   0 .13 .06   0   0   0 .02   0   0   0   0
JM062 001 1  7  0  1 3420   12 00 126 000 0000010500 0 1
JM062 002 1  3  0  2 2310   36 00
JM062 003 1  2  0  1 2280   41 00
JM062 004 1  2 14  1 2150   49 00
JM062 005 1  7  2  1 2380   59 00
JM062 006 1  2 14  1 2150   74 00
JM062 007 1  7  0  1 2350   82 00
JM062 008 1  7  0  5 1720   36 00
JM062 009 1  1  0  1 1680   45 00
JM062 010 1  3 14  1 1660   46 00
JM062 011 1  3  0  1 1560   33 00
JM062 012 1  3  0  2 1580   36 00
JM062 013 1  2 14  1 1590   41 00
JM062 014 1  2  0  1 3270   44 00
JM062 015 1  3  0  1 2850   62 00
JM062 016 1  2 14  1 2700  107 00
JM062 017 1  3  0  1 1290   51 00
JM062 018 1  3  0  1 1290   51 00
JM062 019 1  3 13  3 1340   90 00
JM062 020 1  7  0  1 1340   87 00
JM062 021 1  0 30 15 1330   92 00
JM062 022 1  1 14  1 1210  116 00
JM062 023 1  7  0  1 1210  116 00
JM062 024 1  0 31 15 1210  116 00
JM062 025 1  1 14  1 1210  121 00
JM062 026 1  2 14  1 1220  204 00
```

Table 14.1 - continued

JM062	027	1	0	0	0	1240	231	01
JM062	028	1	3	0	1	1200	248	00
JM062	029	1	2	0	1	1050	154	00
JM062	030	1	3	0	1	870	76	00
JM062	031	1	7	0	1	890	139	00
JM062	032	1	7	0	1	890	139	00
JM062	033	1	1	0	1	900	145	00
JM062	034	1	1	0	1	910	148	00
JM062	035	1	7	0	1	850	145	00
JM062	036	1	7	0	1	830	144	00
JM062	037	1	2	14	1	680	111	00
JM062	038	1	3	14	1	700	119	00
JM062	039	1	7	0	3	550	103	00
JM062	040	1	7	0	5	380	77	00
JM062	041	1	2	0	2	240	66	00
JM062	042	1	7	0	12	220	93	00
JM062	043	1	7	0	2	170	96	00
JM062	044	1	7	0	1	330	107	00
JM062	045	1	1	0	5	310	199	00
JM062	046	1	7	0	2	320	201	00
JM062	047	1	2	14	1	460	194	00
JM062	048	1	7	0	1	580	255	00
JM062	049	1	7	1	1	660	260	00
JM062	050	1	2	0	1	660	242	00
JM062	051	1	2	0	1	660	242	00
JM062	052	1	3	0	3	680	198	00
JM062	053	1	3	14	3	750	178	00
JM062	054	1	2	14	1	760	175	00
JM062	055	1	3	14	1	770	170	00
JM062	056	1	2	0	1	800	179	00
JM062	057	1	3	14	3	800	179	00
JM062	058	1	7	0	1	850	170	00
JM062	059	1	4	10	2	820	170	00
JM062	060	1	7	0	5	870	186	00
JM062	061	1	4	10	8	840	209	00
JM062	062	1	7	0	6	900	229	00
JM062	063	1	2	14	1	950	209	00
JM062	064	1	7	0	5	970	224	00
JM062	065	1	7	0	2	850	251	00
JM062	066	1	0	0	0	830	251	01
JM062	067	1	7	3	3	750	279	00
JM062	068	1	2	14	1	990	246	00
JM062	069	1	1	14	1	990	253	00
JM062	070	1	3	14	5	1020	219	00
JM062	071	1	3	0	1	1050	240	00
JM062	072	1	7	0	1	1020	254	00
JM062	073	1	7	0	1	1030	268	00
JM062	074	1	2	0	1	1110	317	00
JM062	075	1	1	0	1	1110	317	00
JM062	076	1	0	31	15	970	340	00
JM062	077	1	4	13	2	960	327	00
JM062	078	1	2	0	2	1000	378	00
JM062	079	1	7	0	1	1010	395	00
JM062	080	1	3	0	6	990	425	00
JM062	081	1	2	0	3	950	535	00
JM062	082	1	7	0	3	950	535	00
JM062	083	1	3	0	2	900	363	00
JM062	084	1	2	0	3	900	305	00
JM062	085	1	4	14	3	850	344	00
JM062	086	1	7	1	1	870	401	00
JM062	087	1	7	0	3	900	402	00
JM062	088	1	7	0	2	810	340	00

Table 14.1 - continued

```
JM062 089 1  3 14  1  780  305 00
JM062 090 1  0 30 15  780  298 00
JM062 091 1  3  0  1  800  364 00
JM062 092 1  0 30 15  790  412 00
JM062 093 1  3 14  1  750  337 00
JM062 094 1  7  0  1  750  337 00
JM062 095 1  7  0  5  710  389 00
JM062 096 1  7  0  2  700  384 00
JM062 097 1  7  0  1  690  354 00
JM062 098 1  3 14  9  680  379 00
JM062 099 1  3  0  1  660  386 00
JM062 100 1  7  0  1  650  381 00
JM062 101 1  3  0  1  580  425 00
JM062 102 1  7  1  1  570  427 00
JM062 103 1  3  0  2  550  415 00
JM062 104 1  7  0  5  540  421 00
JM062 105 1  3 14  1  540  423 00
JM062 106 1  1  0  8  540  424 00
JM062 107 1  3 14  1  500  427 00
JM062 108 1  4 14  3  490  363 00
JM062 109 1  3  0  1  500  363 00
JM062 110 1  3  0  1  350  360 00
JM062 111 1  0 30 15  360  336 00
JM062 112 1  2  0  1  370  299 00
JM062 113 1  7  0  1  350  305 00
JM062 114 1  3  0  1  340  325 00
JM062 115 1  7  0  3  310  324 00
JM062 116 1  3  0  2  310  324 00
JM062 117 1  2  0  1  310  325 00
JM062 118 1  3  0  1  290  336 00
JM062 119 1  1  0  1  320  344 00
JM062 120 1  7  1  1  320  338 00
JM062 121 1  7  1  1  320  338 00
JM062 122 !  7  0  1  320  338 00
JM062 123 1  7  0  1  320  338 00
JM062 124 1  7  1  1  320  338 00
JM062 125 1  7  0  3  320  338 00
JM062 126 1  1  0  1  330  349 00
JM062 100 2 005 005 2300 11690 05180 0107 06250 00153 01620 999 1 0800 23031000
JM062     3 674820 421572 02    010500  11 1200000 0019 0012 .05 .01 .02 .02   0
JM062     4   0 .21   0 .03 .02 .30 .06 .10 .17   0   0   0   0   0   0   0   0
JM063 001 1  3 14  1 1090  114 00  58 000 0000012800 0 1
JM063 002 1  0  0 15 1010  122 08
JM063 003 1  2 14  1  920  197 00
JM063 004 1  3 14  2  910  169 00
JM063 005 1  1 14  1  830  129 00
JM063 006 1  3  0  1  830  129 00
JM063 007 1  3  0  2  840  158 00
JM063 008 1  3 14  3  840  158 00
JM063 009 1  3  0  0  840  164 00
JM063 010 1  2 14  1  820  175 00
JM063 011 1  7  0  1  820  175 00
JM063 012 1  2  0  1  750  185 00
JM063 013 1  2 14  1  690  162 00
JM063 014 1  3 14  1  680  239 00
JM063 015 1  3  0  1  540  151 00
JM063 016 1  7  0 12  540  170 00
JM063 017 1  7  0  1  540  170 00
JM063 018 1  7  0  1  490   68 00
JM063 019 1  3 14  6 3230   19 00
JM063 020 1  3 14  1 3310   54 00
JM063 021 1  7  0  3 3340  129 00
```

AD A147 028 A CULTURAL RESOURCES INVENTORY OO THE JOHN MARTIN RESERVOIR COLORADO(U) SCIENCE APPLICATIONS INC GOLDEN CO F W EDDY ET AL. 31 AUG 82 DACW47-80-C-0002

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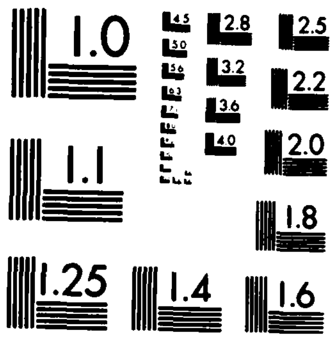
UNCLASSIFIED F/G 5/6 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 14.1 - continued

```
JM063 022 1  3  0  9 3450   153 00
JM063 023 1  7  0  1 3210   141 00
JM063 024 1  3  0  7 3200   163 00
JM063 025 1  3  0  1 3020   123 00
JM063 026 1  3  0  7 3140   213 00
JM063 027 1  7  0  3 3050   290 00
JM063 028 1  7  0  1 2680   236 00
JM063 029 1  7  0  3 2850   149 00
JM063 030 1  3 14  1 2850   149 00
JM063 031 1  7  0  2 3380   221 00
JM063 032 1  7  0  3   80   194 00
JM063 033 1  6 16  2   80   174 00
JM063 034 1  3  0  1   50   224 00
JM063 035 1  2  0  1 3570   249 00
JM063 036 1  2 14  1 3570   276 00
JM063 037 1  2 14  1 3590   279 00
JM063 038 1  2  0  1   40   281 00
JM063 039 1  2  0  1   70   285 00
JM063 040 1  7  1  1 3510   331 00
JM063 041 1  2  0  4 3400   281 00
JM063 042 1  1  0  1 3330   486 00
JM063 043 1  7  0  1 3410   463 00
JM063 044 1  7  0  1 3310   594 00
JM063 045 1  7  0  1 3310   594 00
JM063 046 1  7  4  0   80   432 00
JM063 047 1  3  0  1  150   293 00
JM063 048 1  3  0  1  190   320 00
JM063 049 1  7  1  1  140   480 00
JM063 050 1  7  0  1  140   480 00
JM063 051 1  3 14  1  140   485 00
JM063 052 1  3  0  1  220   501 00
JM063 053 1  7  4  1  210   577 00
JM063 054 1  4 10  1  250   489 00
JM063 055 1  7  0  1  310   434 00
JM063 056 1  7  0  3  320   342 00
JM063 057 1  3  0  1  290   335 00
JM063 058 1  1  0  2  270   332 00
JM063 100 2 020 015 0500 11674 02286 0092 07803 00137 01520 999 1 0800 23031000
JM063     3 675050 421578 00    012800    9 0453125 0019 0012 .03   0   0 .02   0
JM063     4   0 .24   0   0   0 .29 .03 .09 .22   0 .02   0 .03   0   0   0   0
JM064 001 1  7  0  3 3200    54 00  78 000 0000059500 0 1
JM064 002 1  2  0  1 3100   137 00
JM064 003 1  2 14  1 3120   132 00
JM064 004 1  7  0  1 3160   148 00
JM064 005 1  7  0  1 3180   142 00
JM064 006 1  4  0  1 3220   138 00
JM064 007 1  1 14  1 3240    97 00
JM064 008 1  2 14  1 3300    79 00
JM064 009 1  1 13  1 3300    88 00
JM064 010 1  3  0  1 3320   112 00
JM064 011 1  3  0  1 3300   142 00
JM064 012 1  7  0  1 3300   186 00
JM064 013 1  7  0  1 3300   187 00
JM064 014 1  1 14  1 3400   209 00
JM064 015 1  7  0  1 3460   202 00
JM064 016 1  1 14  1 3410   197 00
JM064 017 1  2 14  1 3520   185 00
JM064 018 1  7  0  1 3470    93 00
JM064 019 1  1 14  1   70   100 00
JM064 020 1  1 14  1   40   103 00
JM064 021 1  7  1  1  190    55 00
JM064 022 1  3  0  1  170    56 00
```

Table 14.1 - continued

```
JM064 023 1  7  4  1  210   83 00
JM064 024 1  2  0  1  150  124 00
JM064 025 1  2  0  1  290  124 00
JM064 026 1  1 14  1  320  100 00
JM064 027 1  2 14  7  390  103 00
JM064 028 1  1 14  1  180  131 00
JM064 029 1  3 14  1  420  165 00
JM064 030 1  1 14  1  490   92 00
JM064 031 1  3 14  1  420  164 00
JM064 032 1  7  1  1  500  125 00
JM064 033 1  7  1  1  550  132 00
JM064 034 1  1  0  1  540  135 00
JM064 035 1  1 14  7  590  125 00
JM064 036 1  7  1  1  590  122 00
JM064 037 1  2 13  1  580  119 00
JM064 038 1  3 14  1  570  159 00
JM064 039 1  2 12  1  640  156 00
JM064 040 1  2  0  1  660  163 00
JM064 041 1  2 14  1  720   88 00
JM064 042 1  4 10  4  750  185 00
JM064 043 1  1 14  3  760  190 00
JM064 044 1  2 14  1  820  195 00
JM064 045 1  7  1  1  690  310 00
JM064 046 1  7  1  1  720  304 00
JM064 047 1  7  1  1  710  301 00
JM064 048 1  7  1  1  790  343 00
JM064 049 1  0  0 15  800  382 08
JM064 050 1  7  1  1  790  425 00
JM064 051 1  1  0  1  860  373 00
JM064 052 1  1 14  1  840  359 00
JM064 053 1  1 14  1  860  340 00
JM064 054 1  1  0  1  900  340 00
JM064 055 1  2  0  1  900  304 00
JM064 056 1  1 14  1  900  385 00
JM064 057 1  0 31  0  890  401 00
JM064 058 1  7  2  1 1000  398 00
JM064 059 1  1 14  1 1000  398 00
JM064 060 1  2 14  1 1020  389 00
JM064 061 1  7  0  1 1060  385 00
JM064 062 1  1 14  1  930  331 00
JM064 063 1  3 14  1  950  239 00
JM064 064 1  1 14  1  920  223 00
JM064 065 1  7  1  1  910  225 00
JM064 066 1  7  1  1 1420  363 00
JM064 067 1  3 14  1 1410  514 00
JM064 068 1  3 14  1 1420  523 00
JM064 069 1  7  1  1 1670  565 00
JM064 070 1  3 14  1 1690  345 00
JM064 071 1  1  0  3 1690  345 00
JM064 072 1  1 14  1 1740  415 00
JM064 073 1  1 14  1 2060  567 00
JM064 074 1  7  1  1 2060  567 00
JM064 075 1  7  3  1 2400  276 00
JM064 076 1  3 14  1 2560   65 00
JM064 077 1  1 13  1 2660   88 00
JM064 078 1  3 14  1 2660   88 00
JM064 006 2 010 010 2100 11729 01524 0040 17678 00192 00420 986 2 0800 23031000
JM064     3 675080 421686 00     059500  13 0131092 0029 0016 .17 .01 .05 .01    0
JM064     4 .01 .44    0    0 .01 .10 .05 .06 .04    0    0 .01 .01    0    0    0    0
JM066 001 1  4  0  1 3110  450 00  39 000 0000180030 0 1
JM066 002 1  3 14  1 3090  419 00
JM066 003 1  7  0  1 3090  390 00
```

Table 14.1 - continued

```
JM066 004 1   1 14  1 3090   384 00
JM066 005 1   3 14  1 3100   359 00
JM066 006 1   3 14  1 3100   359 00
JM066 007 1   7  1  1 3080   340 00
JM066 008 1   1 14  1 3090   268 00
JM066 009 1   7  0  1 3070   237 00
JM066 010 1   2 14  1 3050   247 00
JM066 011 1   1 14  1 3040   248 00
JM066 012 1   3 14  1 3000   256 00
JM066 013 1   7  0  1 2990   197 00
JM066 014 1   7  0  5 2980   215 00
JM066 015 1   7  0  2 2980   252 00
JM066 016 1   7  0  2 3050   284 00
JM066 017 1   3  0  1 3190   190 00
JM066 018 1   3 14  1 3190   190 00
JM066 019 1   2 14  1 3200   191 00
JM066 020 1   1 14  1 3290   172 00
JM066 021 1   1 14  1 3310   149 00
JM066 022 1   2 14  1 3440   157 00
JM066 023 1   7  0  1 3390   192 00
JM066 024 1   7  1  1 3270   216 00
JM066 025 1   7  1  1 3270   250 00
JM066 026 1   2 14  1 3350   266 00
JM066 027 1   1 14 17 3420   251 00
JM066 028 1   7  0  1   30   185 00
JM066 029 1   7  1  1 3120   264 00
JM066 030 1   7  0  1 3150   306 00
JM066 031 1   3 14  1 3150   316 00
JM066 032 1   0 31  2 3110   310 00
JM066 033 1   7  1  1 3120   362 00
JM066 034 1   7  0 17 3120   361 00
JM066 035 1   1 14 17 3120   361 00
JM066 036 1   1 14  1 3190   355 00
JM066 037 1   7  0  3 3210   323 00
JM066 038 1   2 14  1 3230   340 00
JM066 039 1   1 14  1 3230   389 00
JM066 006 2 050 050 0260 11710 03330 0051 22670 00189 00460 999 1 0800 23031000
JM066     3 675540 421654 00     180000    5 0022222 0019 0014 .13    0    0    0    0
JM066     4    0 .51    0    0 .03 .28    0    0 .03    0    0 .03    0    0    0    0    0
JM067 001 1   7  0  1 2300    51 00  49 000 0000054000 0 1
JM067 002 1   3  0  1 3320   135 00
JM067 003 1   0 32 15  250   135 00
JM067 004 1   2 14  6  180   219 00
JM067 005 1   2  0  1  190   220 00
JM067 006 1   1 14  1  200   321 00
JM067 007 1   1 14  1  180   424 00
JM067 008 1   2 14  1  200   561 00
JM067 009 1   3 14  1  200   600 00
JM067 010 1   1  0  2   50   640 00
JM067 011 1   0 31 15   80   800 00
JM067 012 1   1 14  1  310   230 00
JM067 013 1   1  0  1  310   329 00
JM067 014 1   2 14  2  320   544 00
JM067 015 1   0 30 15  390   302 00
JM067 016 1   1 14  1  430   498 00
JM067 017 1   1 14  1  430   582 00
JM067 018 1   2 14  1  450   542 00
JM067 019 1   7  0  1  470   406 00
JM067 020 1   3 14  1  490   422 00
JM067 021 1   0 32 14  500   265 00
JM067 022 1   0  0 15  480   125 08
JM067 023 1   7  0  1  450   127 00
```

Table 14.1 - continued

```
JM067 024 1   0  0 15  690    94 08
JM067 025 1   1  0  2  850    94 00
JM067 026 1   7  0  3  680   220 00
JM067 027 1   3 14  2  610   353 00
JM067 028 1   7  0  8  600   431 00
JM067 029 1   1  0  1  570   452 00
JM067 030 1   1  0  1  580   527 00
JM067 031 1   3  0  1  600   492 00
JM067 032 1   2  0  2  640   488 00
JM067 033 1   1  0  2  640   335 00
JM067 034 1   3  0  5  660   399 00
JM067 035 1   2  0  3  680   405 00
JM067 036 1   2  0  1  750   254 00
JM067 037 1   2  0  1  710   241 00
JM067 038 1   0  0 15  810   254 08
JM067 039 1   3  0  1 1010   259 08
JM067 040 1   3  0  2 1010   259 08
JM067 041 1   3  0  5 1010   259 08
JM067 042 1   2  0  1 1000   203 08
JM067 043 1   7  0  8 1020   204 08
JM067 044 1   2  0  1 1010   175 08
JM067 045 1   3 14  3  970    77 08
JM067 046 1   7  0  3 1100   141 08
JM067 047 1   1 14  1 1240   152 08
JM067 048 1   1  0  1 1350   128 00
JM067 049 1   2 14  1 1490    64 00
JM067 006 2 010 010 0300 11780 07330 0045 16670 00076 00050 856 2 0800 23031000
JM067     3 664700 421720 00     054000    7 0090740 0019 0003    0    0    0    0    0
JM067     4    0 .31    0 .02 .02 .14 .14 .14 .12    0    0    0    0    0 .04    0    0
JM068 001 1   0 32 15  270   135 00 118 000 0000143000 0 9
JM068 002 1   0 30 15 3490   125 00
JM068 003 1   2  0 14 3220   193 00
JM068 004 1   0 31 15 3120   200 00
JM068 005 1   3 14  1 2970   177 00
JM068 006 1   7  0  1 2920   177 00
JM068 007 1   3  0  1 2940   197 00
JM068 008 1   3 14  3 2960   213 00
JM068 009 1   3 14  2 2970   224 00
JM068 010 1   3 14  2 2980   235 00
JM068 011 1   0 32 15 2940   250 00
JM068 012 1   2  0  1 2940   250 00
JM068 013 1   0 31 15 3010   250 00
JM068 014 1   1  0  8 3030   275 00
JM068 015 1   3  0  1 3000   322 00
JM068 016 1   3  0  1 2960   333 00
JM068 017 1   3 14  1 3010   235 00
JM068 018 1   1 14  3 2910   310 00
JM068 019 1   1  0  3 2970   323 00
JM068 020 1   0 31 14 2940   520 00
JM068 021 1   0 30 15 2940   530 00
JM068 022 1   0 30 15 2910   530 00
JM068 023 1   0 31 14 2810   572 00
JM068 024 1   3 14  2 2820   186 00
JM068 025 1   1 14  2 2750   223 00
JM068 026 1   3  0  3 2670   240 00
JM068 027 1   2 14  3 2600   237 00
JM068 028 1   0 32 15 2390   274 00
JM068 029 1   7  0  1 2300   330 00
JM068 030 1   3 14  5 2140   263 00
JM068 031 1   3  0  1 2070   313 00
JM068 032 1   1  0  6 2060   320 00
JM068 033 1   1 14  1 1990   331 00
```

Table 14.1 - continued

JM068	034	1	0	32	14	1470	84	00
JM068	035	1	2	0	5	1550	177	00
JM068	036	1	2	14	1	1450	290	00
JM068	037	1	1	0	1	1510	417	00
JM068	038	1	0	32	15	1630	301	00
JM068	039	1	1	14	1	1620	292	00
JM068	040	1	7	0	3	1350	238	00
JM068	041	1	3	0	2	1260	238	00
JM068	042	1	1	14	8	1230	260	00
JM068	043	1	2	0	1	1240	349	00
JM068	044	1	0	31	14	1260	382	00
JM068	045	1	0	31	15	1060	523	00
JM068	046	1	0	31	14	1050	533	00
JM068	047	1	2	14	2	1030	506	00
JM068	048	1	3	0	1	960	566	00
JM068	049	1	1	14	1	940	566	00
JM068	050	1	2	0	2	820	620	00
JM068	051	1	1	14	2	800	670	00
JM068	052	1	0	32	15	760	590	00
JM068	053	1	3	0	1	790	497	00
JM068	054	1	6	14	2	800	500	00
JM068	055	1	3	14	3	730	462	00
JM068	056	1	3	14	1	810	464	00
JM068	057	1	7	0	2	820	415	00
JM068	058	1	3	14	1	820	392	00
JM068	059	1	1	0	2	840	400	00
JM068	060	1	1	0	1	840	381	00
JM068	061	1	3	0	1	850	371	00
JM068	062	1	3	14	1	860	348	00
JM068	063	1	1	0	1	910	433	00
JM068	064	1	0	31	14	940	464	00
JM068	065	1	3	0	1	990	466	00
JM068	066	1	1	0	3	970	417	00
JM068	067	1	3	0	2	1000	397	00
JM068	068	1	3	14	1	1060	368	00
JM068	069	1	1	14	1	990	355	00
JM068	070	1	2	14	4	1010	323	00
JM068	071	1	1	0	1	1050	295	00
JM068	072	1	2	14	1	1060	263	00
JM068	073	1	1	14	3	1010	240	00
JM068	074	1	3	14	1	740	229	00
JM068	075	1	3	14	3	630	170	00
JM068	076	1	3	14	2	1100	116	00
JM068	077	1	1	14	1	1120	115	00
JM068	078	1	7	0	1	1120	115	00
JM068	079	1	2	0	1	1210	73	00
JM068	080	1	2	14	1	410	83	00
JM068	081	1	2	0	1	420	89	00
JM068	082	1	3	14	6	650	90	00
JM068	083	1	0	32	15	650	91	00
JM068	084	1	1	0	1	610	110	00
JM068	085	1	2	14	1	620	117	00
JM068	086	1	0	32	14	950	257	00
JM068	087	1	1	0	1	1040	241	00
JM068	088	1	0	32	15	1310	122	00
JM068	089	1	7	0	3	1370	155	00
JM068	090	1	1	0	1	1500	265	00
JM068	091	1	2	0	1	1480	287	00
JM068	092	1	0	32	15	1810	313	00
JM068	093	1	0	32	15	1860	336	00
JM068	094	1	2	14	1	1850	367	00
JM068	095	1	2	14	3	1870	395	00

Table 14.1 - continued

```
JM068 096 1  0 32 15 1880  434 00
JM068 097 1  2  0 11 18[illegible]0  466 00
JM068 098 1  0 32 15 1900  466 00
JM058 099 1  3  0  3 1920  451 00
JM068 100 1  1  0  1 1930  438 00
JM068 101 1  3 14 11 1930  427 00
JM068 102 1  0 32 15 1950  418 00
JM068 103 1  2  0  2 2020  479 00
JM068 104 1  0 31 15 2010  398 00
JM068 105 1  0 32 15 1950  146 00
JM068 106 1  7  0  1 2130  135 00
JM068 107 1  3  0  2 2100  171 00
JM068 108 1  2  0  1 2100  171 00
JM068 109 1  2 14  1 2110  194 00
JM068 110 1  0 32 15 2120  216 00
JM068 111 1  3 14  1 2140  208 00
JM068 112 1  2 14  1 2150  221 00
JM068 113 1  2 14  2 2140  187 00
JM068 114 1  0 32 15 2260  134 00
JM068 115 1  0  0 15 2320  178 08
JM068 116 1  1  0  1 2290  213 00
JM068 117 1  1  0  1 2240  245 00
JM068 118 1  0 32 15 2350  232 00
 2060 0460 0000 0000 0000 0000 080 000 000 118 000 000
JM068 026 2 015 025 1200 11781 05334 0092 06706 00107 00030 802 2 1000 33233020
JM068     3 664910 421719 00    143000   8 0082517 0019 0003    0    0    0    0    0
JM068     4   0 .35   0 .03 .08 .06 .13 .09 .11   0 .01    0    0    0 .15    0    0
JM069 001 1  1 14  1 3130  232 00  93 000 0000102180 0 9
JM069 002 1  1 14  2 3120  238 00
JM069 003 1  3 14  1 2980  200 00
JM069 004 1  3 14  6 2970  171 00
JM069 005 1  3 14  1 2960  105 00
JM069 006 1  2 14  1 2830  282 00
JM069 007 1  2  0  1 2820  264 00
JM069 008 1  3 14  1 2800  265 00
JM069 009 1  3 14  1  275  315 00
JM069 010 1  2 14  1  270  258 00
JM069 011 1  3 14  1 2680  201 00
JM069 012 1  3  0  2 2720  190 00
JM069 013 1  3 14  2 2640  171 00
JM069 014 1  1  0  1 2740  114 00
JM069 015 1  3 14  1 2540  109 00
JM069 016 1  3 14  1 2610  240 00
JM069 017 1  1  0  2 2590  247 00
JM069 018 1  1 14  1 2610  225 00
JM069 019 1  3 14  1 2620  197 00
JM069 020 1  3 14 14 2590  190 00
JM069 021 1  3 14  5 2590  190 00
JM069 022 1  4  0  5 2570  224 00
JM069 023 1  7  1  1 2550  223 00
JM069 024 1  2 14  1 2560  215 00
JM069 025 1  1 14  1 2560  209 00
JM069 026 1  0 32 15 2570  199 00
JM069 027 1  3 14 14 2540  193 00
JM069 028 1  3 14  3 2540  189 00
JM069 029 1  2  0  1 2550  180 00
JM069 030 1  2 14  1 2560  168 00
JM069 031 1  1 14  1 2430  202 00
JM069 032 1  2 14  2 2430  195 00
JM069 033 1  7  0  1 2360  207 00
JM069 034 1  3  0  5 2380  208 00
JM069 035 1  3 14  1 2390  196 00
```

Table 14.1 - continued

```
JM069 036 1  4  0  3 2370  229 00
JM069 037 1  2 14  1 2370  237 00
JM069 038 1  2 14 11 2450  267 00
JM069 039 1  3 14  1 2440  275 00
JM069 040 1  3 14  1 2310  213 00
JM069 041 1  1 14  1 2300  197 00
JM069 042 1  3 14  2 2380  163 00
JM069 043 1  2 14  2 2270  138 00
JM069 044 1  3 14  8 2280  126 00
JM069 045 1  7  0  1 2290  121 00
JM069 046 1  3 14  3 2270  100 00
JM069 047 1  1  0  1 2380   96 00
JM069 048 1  3 14 14 2220   91 00
JM069 049 1  3 14  3 2260   74 00
JM069 050 1  7  1  1 1730  126 00
JM069 051 1  3 14  2 1900  224 00
JM069 052 1  1 14  1 1920  425 00
JM069 053 1  3 14  1 2020  393 00
JM069 054 1  2 14  1 2020  393 00
JM069 055 1  7  1  1 2110  388 00
JM069 056 1  3 14  1 1610  560 00
JM069 057 1  7  0  1 1170  238 00
JM069 058 1  7  0  1 1240  183 00
JM069 059 1  1 14  1  810  213 00
JM069 060 1  2 14  2  760  234 00
JM069 061 1  2 14  1  700  258 00
JM069 062 1  4 10  2   80   57 00
JM069 063 1  2 14  3  430   31 00
JM069 064 1  0 32 14  480   42 00
JM069 065 1  3 14  1  600   38 00
JM069 066 1  2 14  1  920   85 00
JM069 067 1  3 14  1 1120   85 00
JM069 068 1  7  0  5 1120   68 00
JM069 069 1  3 14  1 1270   64 00
JM069 070 1  3  0  1 1390  124 00
JM069 071 1  3  0  1 1340  116 00
JM069 072 1  2 14  2 1340  120 00
JM069 073 1  2  0  2 1330  114 00
JM069 074 1  1 14  5 1150  115 00
JM069 075 1  2 14  1 1270  208 00
JM069 076 1  1 14  3 1250  195 00
JM069 077 1  2 14  3 1580  239 00
JM069 078 1  1 14  3 1110  249 00
JM069 079 1  3 14  1 1000  285 00
JM069 080 1  1 14  1  850  382 00
JM069 081 1  3 14  3  880  409 00
JM069 082 1  3 14  1  760  506 00
JM069 083 1  3 14  2  740  536 00
JM069 084 1  0 32 15  650  454 00
JM069 085 1  7  1  1  670  361 00
JM069 086 1  2  0  1  630  384 00
JM069 087 1  3 14  1  610  373 00
JM069 088 1  1 14  1  590  368 00
JM069 089 1  0 32 14  540  278 00
JM069 090 1  4 13  1 1770   20 00
JM069 091 1  7  1  1 2230  125 00
JM069 092 1  7  1  1 2610   52 00
JM069 093 1  1 14  3 2630   82 00
 0670 0500 0000 0000 0000 0000 062 000 000 093 000 000
JM069 006 2 010 100 3600 11771 08230 0006 09520 00097 00560 999 1 0800 23031000
JM069       3 665540 421779 00     102180    9 0091015 0010 0013 .06    0 .01 .01    0
JM069       4    0 .68    0    0    0 .05 .03 .04 .04    0    0 .02    0    0 .04    0    0
```

Table 14.1 - continued

```
JM070 001 1  7  4  1 2570   51 00  27 000 0000024940 0 1
JM070 002 1  7  4  1 2060   67 00
JM070 003 1  2  0  1 2230  186 00
JM070 004 1  7  4  1 1870  106 00
J7070 005 1  1 14  1 1840  166 00
JM070 006 1  2 14  1 1810  172 00
JM070 007 1  1 13  1 2020  263 00
JM070 008 1  2 14  1 1830  207 00
JM070 009 1  2 14  1 1740   91 00
JM070 010 1  7  4  1 1750  208 00
JM070 011 1  7  0  1 1660  156 00
JM070 012 1  1 14  1 1420  186 00
JM070 013 1  2 14  1 1340  136 00
JM070 014 1  7  0  1 1400  272 00
JM070 015 1  7  0  2 1350  229 00
JM070 016 1  2 14  1 1320  163 00
JM070 017 1  2 14  1 1130   69 00
JM070 018 1  2 14  2  700  134 00
JM070 019 1  2 14  1  660  130 00
JM070 020 1  1 17  1  570  272 00
JM070 021 1  7  3  1  340  220 00
JM070 022 1  3 14  1  330  404 00
JM070 023 1  7  1  1  330  395 00
JM070 024 1  3  0  3  410  150 00
JM070 025 1  1 10  1  230  234 00
JM070 026 1  7  1  1 3350  281 00
JM070 027 1  7  1  1 2710  214 00
JM070 006 2 010 035 2250 11826 04330 0076 10000 00183 00240 776 3 0800 23031000
JM070     3 666420 421829 00    025155   9 0107334 0057 0015 .11   0 .07 .04   0
JM070     4   0 .41   0   0   0 .11   0 .04 .04   0   0   0 .15 .04   0   0   0
JM072 001 1  1  0  3  790   32 00  40 000 0000017600 0 1
JM072 002 1  2  0  6  820  136 00
JM072 003 1  7  0  3  780  144 00
JM072 004 1  1 14  2  660  135 00
JM072 005 1  1 14  1  630  107 00
JM072 006 1  2 14  2  640  207 00
JM072 007 1  1  0  3  610  149 00
JM072 008 1  1 14  4  610  154 00
JM072 009 1  1  0  1  480  147 00
JM072 010 1  1  0  1  390  202 00
JM072 011 1  2 14  1  370  274 00
JM072 012 1  1 13  1 3500   86 00
JM072 013 1  1 14  2 3440   84 00
JM072 014 1  7  2  1 3390   74 00
JM072 015 1  1  0  3 2600   57 00
JM072 016 1  2 14  3 2370   84 00
JM072 017 1  7  0  3 2510  144 00
JM072 018 1  7  0  3 2500  179 00
JM072 019 1  7  0  5 2520  202 00
JM072 020 1  7  0  5 2490  201 00
JM072 021 1  1  0  1 2430  224 00
JM072 022 1  7  3  1 2360  249 00
JM072 023 1  3  0  2 2450  281 00
JM072 024 1  7  0  3 2360  272 00
JM072 025 1  2 14  3 2350  214 00
JM072 026 1  1  0  2 2320  230 00
JM072 027 1  7  0  3 2310  213 00
JM072 028 1  7  0  3 2300  210 00
JM072 029 1  2  0  2 2300  193 00
JM072 030 1  7  0  3 2300  193 00
JM072 031 1  1  0 11 2300  196 00
JM072 032 1  7  2 14 2290  193 00
```

Table 14.1 - continued

```
JM072 033 1  7  0  3 2280  207 00
JM072 034 1  1  0  1 2240  198 00
JM072 035 1  2  0  1 1940  183 00
JM072 036 1  7  0  1 1670  134 00
JM072 037 1  7  0  3 1490   97 00
JM072 038 1  7  0  3 1490   97 00
JM072 039 1  7  0  4 1250   98 00
JM072 040 1  7  0  3 1060  116 00
JM072 064 2 025 100 2300 11872 08500 0122 10300 00183 00050 679 3 0800 02133030
JM072     3 666800 421833 00    017600   7 0227272 0067 0016   0 .05 .05   0   0
JM072     4   0 .20   0    0   0 .38 .23 .08 .03   0    0    0    0    0    0    0   0
JM073 001 1  7  0  1 1390  156 00  93 000 0000032000 0 1
JM073 002 1  4  0  5 1480   99 00
JM073 003 1  3  0  2 1400  226 00
JM073 004 1  4  0  3 1400  228 00
JM073 005 1  2 14  3 1730  149 00
JM073 006 1  2  0  3 1770  151 00
JM073 007 1  2  0  1 1820  149 00
JM073 008 1  1  0  1 1900  148 00
JM073 009 1  1  0  3 1950  140 00
JM073 010 1  1 14  1 1950  103 00
JM073 011 1  4  0  3 1860  375 00
JM073 012 1  2  0  1 1980  361 00
JM073 013 1  1  0  1 2020  343 00
JM073 014 1  1  0  2 2040  289 00
JM073 015 1  4  0  3 2110  295 00
JM073 016 1  2  0  3 2110  202 00
JM073 017 1  2 14  1 2070  153 00
JM073 018 1  2  0  1 2070  155 00
JM073 019 1  1  0  3 2170  116 00
JM073 020 1  7  0  1 2190  135 00
JM073 021 1  4  0  3 2240  201 00
JM073 022 1  1 14  3 2280  136 00
JM073 023 1  7  3  1 2300   88 00
JM073 024 1  1  0  3 2440  129 00
JM073 025 1  4  0  3 2460  162 00
JM073 026 1  2  0  3 2500  150 00
JM073 027 1  7  3  3 2520  151 00
JM073 028 1  4  0  5 2560  130 00
JM073 029 1  4  0  3 2560  130 00
JM073 030 1  4  0  3 2450  219 00
JM073 031 1  2  0  9 2460  251 00
JM073 032 1  3  0  3 2550  273 00
JM073 033 1  4  0  3 2550  279 00
JM073 034 1  1  0  6 2540  309 00
JM073 035 1  1  0  6 2550  310 00
JM073 036 1  4  0  3 2590  158 00
JM073 037 1  1  0  3 2600  167 00
JM073 038 1  1  0 11 2610  200 00
JM073 039 1  2  0  3 2650  278 00
JM073 040 1  1  0  1 2630  148 00
JM073 041 1  4  0  3 2710  170 00
JM073 042 1  4  0  3 2690  184 00
JM073 043 1  4  0  3 2710   60 00
JM073 044 1  4  0  3 1010  111 00
JM073 045 1  7  0  3  950  241 00
JM073 046 1  2  0  3  870  241 00
JM073 047 1  2  0  1  850  234 00
JM073 048 1  1  0  1  850  234 00
JM073 049 1  4  0  5  860  260 00
JM073 050 1  4  0  3  800  162 00
JM073 051 1  4  0  3  780  228 00
```

Table 14.1 - continued

```
JM073 052 1  7  2  1  780   228 00
JM073 053 1  7  0  1  790    90 00
JM073 054 1  4  0  6  780    89 00
JM073 055 1  4  0  3  610    86 00
JM073 056 1  2  0  1  750   211 00
JM073 057 1  2  0  1  750   211 00
JM073 058 1  4  0  3  740   221 00
JM073 059 1  4  0  3  650   199 00
JM073 060 1  1  0  1  590   188 00
JM073 061 1  1  0  3  510   172 00
JM073 062 1  7  0  3  580   269 00
JM073 063 1  7  3  1  670   211 00
JM073 064 1  4  0  3  660   276 00
JM073 065 1  2  0  3  810   313 00
JM073 066 1  1  0  3  840   360 00
JM073 067 1  2  0 11  780   363 00
JM073 068 1  1  0  2  780   363 00
JM073 069 1  7  0  3  780   362 00
JM073 070 1  4  0  3  750   358 00
JM073 071 1  3  0  3  760   463 00
JM073 072 1  1  0  2  730   456 00
JM073 073 1  4  0  3  720   457 00
JM073 074 1  4  0  3  710   446 00
JM073 075 1  2  0  1  700   460 00
JM073 076 1  2 13  1  700   456 00
JM073 077 1  2 13  1  690   430 00
JM073 078 1  7  2  1  680   422 00
JM073 079 1  1  0  3  650   466 00
JM073 080 1  7  2  1  620   316 00
JM073 081 1  7  0  1  550   445 00
JM073 082 1  7  0  3  550   416 00
JM073 083 1  4  0  3  550   405 00
JM073 084 1  4  0  3  550   367 00
JM073 085 1  4  0  3  530   371 00
JM073 086 1  1  0  3  530   398 00
JM073 087 1  4  0  3  500   386 00
JM073 088 1  4  0  3  430   430 00
JM073 089 1  2  0  2  510   488 00
JM073 090 1  7  0  3  510   416 00
JM073 091 1  2  0  3  480   296 00
JM073 092 1  4 10  3  470   226 00
JM073 093 1  7  0  3  450   231 00
JM073 064 2 040 090 2200 11811 07500 0061 08000 00152 00060 560 3 0800 02133030
JM073     3 666680 421813 00    032000   9 0290625 0076 0016   0 .03  05 .01   0
JM073     4   0 .04   0   0   0 .11 .20 .18 .03   0   0 .33   0   0   0   0   0
JM074 001 1  2 14  2 1760   189 00 100 000 0000025000 0 1
JM074 002 1  1 14  1 1660   201 00
JM074 003 1  4 14  1 1570   189 00
JM074 004 1  1 14  1 1580   188 00
JM074 005 1  2 14  2 1560   183 00
JM074 006 1  7  0  1 1600   137 00
JM074 007 1  7  3  1 1540   140 00
JM074 008 1  7  4  1 1520   140 00
JM074 009 1  7  4  1 1480   145 00
JM074 010 1  7  4  1 1460   148 00
JM074 011 1  7  0  3 1450   145 00
JM074 012 1  7  0  3 1470   127 00
JM074 013 1  1 14  1 1470   127 00
JM074 014 1  7  4  1 1420   116 00
JM074 015 1  7  0  3 1410    90 00
JM074 016 1  1 14  1 1405    91 00
JM074 017 1  1 14  1 1420    92 00
```

Table 14.1 - continued

JM074	018	1	7	0	6	1400	96	00
JM074	019	1	7	4	14	1420	63	00
JM074	020	1	7	0	6	1380	71	00
JM074	021	1	3	14	1	1330	53	00
JM074	022	1	1	14	1	1360	108	00
JM074	023	1	7	4	1	1380	120	00
JM074	024	1	3	14	3	1410	130	00
JM074	025	1	1	14	1	1370	157	00
JM074	026	1	7	4	1	1370	172	00
JM074	027	1	3	0	3	1370	173	00
JM074	028	1	7	0	2	1370	183	00
JM074	029	1	7	4	1	1340	130	00
JM074	030	1	7	1	1	1330	111	00
JM074	031	1	3	14	2	1300	112	00
JM074	032	1	1	16	2	1260	127	00
JM074	033	1	7	4	11	1260	127	00
JM074	034	1	3	14	1	1210	120	00
JM074	035	1	7	4	1	1180	147	00
JM074	036	1	7	1	1	1120	98	00
JM074	037	1	3	14	2	1110	104	00
JM074	038	1	7	0	6	910	134	00
JM074	039	1	3	14	1	20	49	00
JM074	040	1	7	0	2	130	62	00
JM074	041	1	1	14	2	310	99	00
JM074	042	1	7	0	3	370	105	00
JM074	043	1	1	14	2	360	104	00
JM074	044	1	7	0	3	400	204	00
JM074	045	1	7	0	3	380	228	00
JM074	046	1	3	14	1	370	240	00
JM074	047	1	7	0	3	360	246	00
JM074	048	1	7	0	2	360	245	00
JM074	049	1	7	0	2	370	242	00
JM074	050	1	7	0	3	340	288	00
JM074	051	1	7	4	3	370	295	00
JM074	052	1	1	14	6	350	279	00
JM074	053	1	7	0	3	350	300	00
JM074	054	1	1	14	1	250	310	00
JM074	055	1	7	0	3	250	285	00
JM074	056	1	7	1	2	320	263	00
JM074	057	1	7	4	2	300	228	00
JM074	058	1	7	4	6	360	207	00
JM074	059	1	1	14	1	370	203	00
JM074	060	1	1	14	1	360	195	00
JM074	061	1	7	0	2	310	187	00
JM074	062	1	1	14	2	310	178	00
JM074	063	1	7	0	3	210	160	00
JM074	064	1	3	14	2	190	152	00
JM074	065	1	1	0	2	180	147	00
JM074	066	1	7	0	3	240	238	00
JM074	067	1	3	14	1	240	240	00
JM074	068	1	3	14	2	240	244	00
JM074	069	1	7	0	3	280	273	00
JM074	070	1	1	14	5	210	291	00
JM074	071	1	1	14	2	200	293	00
JM074	072	1	7	1	1	210	334	00
JM074	073	1	1	0	2	190	278	00
JM074	074	1	1	14	3	170	268	00
JM074	075	1	1	14	1	140	260	00
JM074	076	1	4	0	6	130	266	00
JM074	077	1	7	1	2	140	270	00
JM074	078	1	1	14	2	120	264	00
JM074	079	1	1	16	6	120	264	00

Table 14.1 - continued

```
JM074 080 1  7  1  0  130   231 00
JM074 081 1  7  0  3  120   218 00
JM074 082 1  1  0  2  110   188 00
JM074 083 1  1  0  2   70   284 00
JM074 084 1  7  1  2   40   271 00
JM074 085 1  1 14  2   20   271 00
JM074 086 1  4 13  3   10   265 00
JM074 087 1  7  4  1   10   218 00
JM074 088 1  7  0  3 3380   222 00
JM074 089 1  7  0  3 3390   196 00
JM074 090 1  1 14  1 3400   204 00
JM074 091 1  2  0  2 3210   252 00
JM074 092 1  2  0  1 3100   473 00
JM074 093 1  7  1  1 3160   149 00
JM074 094 1  7  0  3 3310   129 00
JM074 095 1  1 14  1 3420   127 00
JM074 096 1  7  0  1 3020    85 00
JM074 097 1  1 14  3 2740    74 00
JM074 098 1  1 14  1 2510    90 00
JM074 099 1  1 14  1 2630   170 00
JM074 100 1  2  0  3 1980   186 00
JM074 064 2 050 065 2450 11780 08677 0106 06000 00121 00150 667 3 0800 02133030
JM074     3 666650 421795 00    025000  10 0400000 0067 0016 .08   0 .02   0   0
JM074     4   0 .38   0   0   0 .27 .04 .03 .01   0   0 .01 .14   0   0   0   0
JM075 001 1  7  0  2 1620   131 00 154 000 0000019350 0 1
JM075 002 1  7  1  1 1580   128 00
JM075 003 1  4 13  1 1130    67 00
JM075 004 1  1  0  1  670    44 00
JM075 005 1  7  1  1  710   117 00
JM075 006 1  2  0  2  750   162 00
JM075 007 1  2  0  1  740   193 00
JM075 008 1  2 14  1  650   183 00
JM075 009 1  1 14  1  630   181 00
JM075 010 1  1  0  1  610   191 00
JM075 011 1  1  0  1  590   200 00
JM075 012 1  2  0  1  570   200 00
JM075 013 1  7  0  2  560   195 00
JM075 014 1  4 13  1  550   208 00
JM075 015 1  2  0  2  550   209 00
JM075 016 1  2  0  1  520   179 00
JM075 017 1  2  0  1  400   151 00
JM075 018 1  1  0  1  390   152 00
JM075 019 1  2  0  2  460   269 00
JM075 020 1  3  0  2  460   269 00
JM075 021 1  7  1  1  460   272 00
JM075 022 1  4 13  3  330   276 00
JM075 023 1  7  0  1  310   278 00
JM075 024 1  2  0  1  300   219 00
JM075 025 1  7  2 14  310   194 00
JM075 026 1  7  3  1  310   166 00
JM075 027 1  2  0  1  370   156 00
JM075 028 1  2 14  1  360   112 00
JM075 029 1  1 14  1  320   107 00
JM075 030 1  7  4  1  300   102 00
JM075 031 1  7  0  3  280    99 00
JM075 032 1  7  0  3  230    97 00
JM075 033 1  3  0  2  120    90 00
JM075 034 1  7  0  1  100    72 00
JM075 035 1  1  0  1   90    35 00
JM075 036 1  1  0  2  220   158 00
JM075 037 1  2  0  1  250   194 00
JM075 038 1  1  0  2  250   190 00
```

Table 14.1 - continued

JM075	039	1	1	0	1	260	191	00
JM075	040	1	2	0	1	260	194	00
JM075	041	1	1	0	1	260	194	00
JM075	042	1	1	0	1	260	191	00
JM075	043	1	3	0	1	270	192	00
JM075	044	1	2	0	1	280	198	00
JM075	045	1	1	0	1	250	188	00
JM075	046	1	3	0	1	250	188	00
JM075	047	1	2	0	1	250	191	00
JM075	048	1	2	0	2	240	188	00
JM075	049	1	2	0	2	240	190	00
JM075	050	1	2	0	1	240	211	00
JM075	051	1	2	0	1	240	211	00
JM075	052	1	2	0	1	240	213	00
JM075	053	1	7	0	1	230	215	00
JM075	054	1	7	0	1	250	204	00
JM075	055	1	2	0	1	250	199	00
JM075	056	1	7	0	1	240	199	00
JM075	057	1	2	0	1	260	201	00
JM075	058	1	3	0	1	270	204	00
JM075	059	1	1	0	1	270	206	00
JM075	060	1	7	2	14	270	207	00
JM075	061	1	2	0	1	260	208	00
JM075	062	1	1	0	1	260	218	00
JM075	063	1	1	0	1	280	215	00
JM075	064	1	3	0	1	280	210	00
JM075	065	1	7	2	14	280	213	00
JM075	066	1	3	0	1	280	211	00
JM075	067	1	2	0	1	280	211	00
JM075	068	1	3	0	1	280	205	00
JM075	069	1	2	0	1	280	206	00
JM075	070	1	3	0	1	280	205	00
JM075	071	1	2	0	1	280	203	00
JM075	072	1	3	0	1	280	200	00
JM075	073	1	3	0	1	270	201	00
JM075	074	1	2	0	1	270	198	00
JM075	075	1	3	0	1	270	196	00
JM075	076	1	1	0	1	280	196	00
JM075	077	1	1	0	1	280	196	00
JM075	078	1	2	0	1	280	196	00
JM075	079	1	2	0	1	290	203	00
JM075	080	1	3	0	1	290	206	00
JM075	081	1	4	13	1	10	188	00
JM075	082	1	7	0	3	10	188	00
JM075	083	1	7	0	3	3410	123	00
JM075	084	1	1	0	1	3360	96	00
JM075	085	1	7	0	2	3330	84	00
JM075	086	1	1	0	1	3020	164	00
JM075	087	1	1	0	1	2990	165	00
JM075	088	1	3	0	1	2840	197	00
JM075	089	1	3	0	1	2790	196	00
JM075	090	1	7	0	2	2810	118	00
JM075	091	1	3	0	1	2780	193	00
JM075	092	1	1	0	3	2780	177	00
JM075	093	1	2	0	1	2780	177	00
JM075	094	1	7	0	1	2780	174	00
JM075	095	1	3	0	2	2760	183	00
JM075	096	1	7	1	1	2760	183	00
JM075	097	1	2	0	3	2770	192	00
JM075	098	1	3	0	1	2750	174	00
JM075	099	1	2	0	5	2750	174	00
JM075	100	1	1	0	2	2740	192	00

Table 14.1 - continued

JM075	101	1	2	0	1	2740	98	00											
JM075	102	1	1	0	1	2690	88	00											
JM075	103	1	1	14	3	2730	205	00											
JM075	104	1	1	0	1	2730	205	00											
JM075	105	1	3	0	1	2680	214	00											
JM075	106	1	2	0	1	2670	210	00											
JM075	107	1	2	0	2	2670	208	00											
JM075	108	1	2	0	1	2660	208	00											
JM075	109	1	3	0	1	2660	203	00											
JM075	110	1	3	0	1	2640	197	00											
JM075	111	1	3	0	1	2640	197	00											
JM075	112	1	2	0	1	2650	178	00											
JM075	113	1	3	0	1	2610	208	00											
JM075	114	1	1	0	1	2590	184	00											
JM075	115	1	3	0	1	2580	166	00											
JM075	116	1	4	0	5	2550	238	00											
JM075	117	1	2	14	3	2550	258	00											
JM075	118	1	1	0	1	2570	253	00											
JM075	119	1	1	0	2	2570	253	00											
JM075	120	1	4	0	3	2570	253	00											
JM075	121	1	1	14	1	2610	83	00											
JM075	122	1	1	14	2	2600	49	00											
JM075	123	1	3	0	1	2470	119	00											
JM075	124	1	1	0	3	2420	161	00											
JM075	125	1	3	14	3	2420	164	00											
JM075	126	1	2	0	1	2400	158	00											
JM075	127	1	1	0	2	2320	66	00											
JM075	128	1	2	0	2	2230	63	00											
JM075	129	1	4	0	3	2230	63	00											
JM075	130	1	4	0	1	2190	65	00											
JM075	131	1	3	0	1	2200	156	00											
JM075	132	1	1	14	3	2200	156	00											
JM075	133	1	0	31	15	2200	156	00											
JM075	134	1	7	3	1	2200	159	00											
JM075	135	1	7	1	1	2190	164	00											
JM075	136	1	7	4	3	2210	194	00											
JM075	137	1	1	14	2	2250	211	00											
JM075	138	1	2	0	1	2250	225	00											
JM075	139	1	1	14	1	2280	239	00											
JM075	140	1	1	0	1	2300	268	00											
JM075	141	1	7	4	1	2330	279	00											
JM075	142	1	1	0	1	2340	276	00											
JM075	143	1	7	0	2	2260	264	00											
JM075	144	1	7	2	14	2240	255	00											
JM075	145	1	7	3	1	2120	273	00											
JM075	146	1	2	14	1	2090	277	00											
JM075	147	1	1	14	1	2070	266	00											
JM075	148	1	3	0	1	2030	294	00											
JM075	149	1	1	14	1	2010	304	00											
JM075	150	1	7	1	1	1980	299	00											
JM075	151	1	1	0	1	1990	258	00											
JM075	152	1	3	0	1	1990	339	00											
JM075	153	1	2	14	1	2090	160	00											
JM075	154	1	2	14	2	2090	160	00											
JM075	064	2	010	070	2100	11765	06500	0091	04000	00106	00380	899	2	0800	02133030				
JM075		3	666800	421775	00	019350	11	0795865	0048	0016	.04	.03	.05	0	0				
JM075		4	0	.11	0	0	.01	.10	.20	.25	.18	0	0	.03	.02	0	0	0	0
JM076	001	1	7	3	1	2620	121	00	70	000	0000019950	0	1						
JM076	002	1	1	14	1	2840	105	00											
JM076	003	1	4	0	5	3100	121	00											
JM076	004	1	1	14	1	3130	144	00											
JM076	005	1	7	1	1	3110	164	00											

Table 14.1 - continued

JM076	006	1	1	0	3	2930	173	00
JM076	007	1	2	14	3	2920	210	00
JM076	008	1	1	0	1	3130	211	00
JM076	009	1	1	0	1	3230	256	00
JM076	010	1	7	1	2	3300	241	00
JM076	011	1	7	1	1	3260	141	00
JM076	012	1	7	1	1	3290	116	00
JM076	013	1	4	0	5	3240	106	00
JM076	014	1	2	0	1	3240	106	00
JM076	015	1	7	4	3	3350	173	00
JM076	016	1	2	0	1	3320	194	00
JM076	017	1	7	3	1	3320	254	00
JM076	018	1	7	1	6	3400	306	00
JM076	019	1	7	0	1	3400	181	00
JM076	020	1	7	0	3	3400	289	00
JM076	021	1	7	2	1	3410	302	00
JM076	022	1	1	0	5	3460	349	00
JM076	023	1	4	0	1	3470	345	00
JM076	024	1	7	3	1	3460	329	00
JM076	025	1	2	14	3	3460	304	00
JM076	026	1	2	13	3	3450	241	00
JM076	027	1	3	0	2	3450	284	00
JM076	028	1	2	0	2	3480	318	00
JM076	029	1	7	0	2	3490	318	00
JM076	030	1	1	0	1	3480	314	00
JM076	031	1	2	14	1	3560	330	00
JM076	032	1	2	14	2	3550	113	00
JM076	033	1	4	0	3	3550	375	00
JM076	034	1	2	0	2	3550	255	00
JM076	035	1	4	0	2	3570	232	00
JM076	036	1	1	0	1	3560	200	00
JM076	037	1	2	0	1	80	136	00
JM076	038	1	1	0	3	100	211	00
JM076	039	1	7	0	3	250	130	00
JM076	040	1	3	0	1	300	114	00
JM076'	041	1	1	14	1	510	157	00
JM076	042	1	7	3	1	590	171	00
JM076	043	1	1	0	1	620	176	00
JM076	044	1	7	0	2	600	136	00
JM076	045	1	1	14	2	840	160	00
JM076	046	1	1	14	1	860	156	00
JM076	047	1	1	0	1	920	6	00
JM076	048	1	1	14	1	910	62	00
JM076	049	1	4	0	3	990	94	00
JM076	050	1	2	0	1	1050	103	00
JM076	051	1	1	0	1	1180	154	00
JM076	052	1	2	14	1	1200	160	00
JM076	053	1	1	0	2	1200	205	00
JM076	054	1	7	4	1	1290	175	00
JM076	055	1	1	14	1	1240	111	00
JM076	056	1	7	0	3	1220	112	00
JM076	057	1	4	13	1	1200	124	00
JM076	058	1	1	14	1	1320	187	00
JM076	059	1	1	0	3	1360	182	00
JM076	060	1	1	0	2	1420	189	00
JM076	061	1	1	14	1	1430	185	00
JM076	062	1	1	0	11	1450	170	00
JM076	063	1	1	14	1	1490	201	00
JM076	064	1	7	4	6	1550	211	00
JM076	065	1	1	0	2	1520	150	00
JM076	066	1	7	4	6	1520	60	00
JM076	067	1	1	0	2	1520	60	00

Table 14.1 - continued

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JM076 068 1   7   3   1 1540    60 00
JM076 069 1   1  14   2 1680    70 00
JM076 070 1   1  14   1 1700    92 00
JM076 064 2 040 040 2400 11841 09000 0182 06000 00182 00330 845 3 0800 02133030
JM07S     3 666840 421793 00     020125  10 0347826 0067 0016 .07 .01 .10   0   0
JM076     4   0 .24   0   0   0 .09 .23 .09 .03   0   0 .09 .06   0   0   0   0
JM079 001 1   7   1  11  100    44 00  76 000 0000045000 0 9
JM079 002 1   4  13   2 3060    24 00
JM079 003 1   2   0   2 3030   187 00
JM079 004 1   1  14   2 2910   220 00
JM079 005 1   1  13   1 2750    46 00
JM079 006 1   1  14   1 2750   135 00
JM079 007 1   1  14   1 2510    32 00
JM079 008 1   7   1   2 2490    48 00
JM079 009 1   4  13   1 2510    49 00
JM079 010 1   7   4   3 2400   127 00
JM079 011 1   7   0   5 2250   128 00
JM079 012 1   7   1   1 2240   111 00
JM079 013 1   7   4   1 2170   134 00
JM079 014 1   4  13   1 2200   151 00
JM079 015 1   1  14   1 2050   162 00
JM079 016 1   1  14   1 2040   158 00
JM079 017 1   7   3   1 2030   155 00
JM079 018 1   7   3   1 2020   151 00
JM079 019 1   2  10   3 1940   174 00
JM079 020 1   7   4   1 1860   197 00
JM079 021 1   2   0   6 1830   215 00
JM079 022 1   4  14   1 1800   237 00
JM079 023 1   7   4   1 1800   271 00
JM079 024 1   1   0   1 1610   263 00
JM079 025 1   2   0   2 1580   260 00
JM079 026 1   4  14   3 1580   260 00
JM079 027 1   1  14   2 1280   171 00
JM079 028 1   1  14   1 1120   167 00
JM079 029 1   1   0   2 1100   165 00
JM079 030 1   7   1   1 1150    16 00
JM079 031 1   7   1   1 1050    11 00
JM079 032 1   1  14   2 1020   179 00
JM079 033 1   1  14   3 1000   156 00
JM079 034 1   1  14   1 1000   159 00
JM079 035 1   7   4   1 1000   163 00
JM079 036 1   4   0   3 1010   189 00
JM079 037 1   1  13   2 1030   202 00
JM079 038 1   1  13   1 1000   213 00
JM079 039 1   1  13   2 1000   213 00
JM079 040 1   1   0   3  960   224 00
JM079 041 1   7   4   1  950   222 00
JM079 042 1   4  13   1  950   222 00
JM079 043 1   2   0   3 1050   228 00
JM079 044 1   1  14   1  900   266 00
JM079 045 1   7   4   1  840   211 00
JM079 046 1   7   1   2  780   195 00
JM079 047 1   1  14   2  780   195 00
JM079 048 1   1  14   1  850   172 00
JM079 049 1   7   3   1  740   241 00
JM079 050 1   7   4   1  940   216 00
JM079 051 1   7   4   1  980   115 00
JM079 052 1   7   0   1  920   116 00
JM079 053 1   1   0   1  400    76 00
JM079 054 1   1   0   1  430    84 00
JM079 055 1   7   1   1  470   143 00
JM079 056 1   4  14   3  530   146 00
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Table 14.1 - continued

```
JM079 057 1  1 14  3  340  140 00
JM079 058 1  7  0  1  270  119 00
JM079 059 1  1  0  2  260   82 00
JM079 060 1  7  2  1  240  137 00
JM079 061 1  1  0  1  130  145 00
JM079 062 1  7  1  1  150  168 00
JM079 063 1  7  4  1   20  203 00
JM079 064 1  4  0  3   50  109 00
JM079 065 1  4  0  3   40  170 00
JM079 066 1  2  0  2   40    3 00
JM079 067 1  7  4  1   50  218 00
JM079 068 1  1 14  1   30  268 00
JM079 069 1  7  3  1   30  272 00
JM079 070 1  7  4  1 3520  226 00
JM079 071 1  1  0  2 3470  230 00
JM079 072 1  1  0  1 3410  262 00
JM079 073 1  1 14  1 3400  267 00
JM079 074 1  7  0  3 3400  264 00
JM079 075 1  1  0  2 3490  177 00
JM079 076 1  7  0  3 3570  122 00
 0090 0500 0000 0000 0000 0000 053 000 000 076 000 000
JM079 064 2 050 050 2400 11796 04500 0137 09660 00137 00500 999 2 0800 02133030
JM079     3 667080 421753 00    045000  10 0168888 0057 0016 .11 .01 .16 .01   0
JM079     4   0 .25   0    0    0 .07 .13 .07   0    0    0 .04 .16   0    0    0    0
JM082 001 1  1 14  1 3400  484 00  96 000 0000122400 0 9
JM082 002 1  1 14  1 3550  462 00
JM082 003 1  3 14  6 3560  435 00
JM082 004 1  2 13  1  120  464 00
JM082 005 1  1 14  1   20  760 00
JM082 006 1  1 14  1   80  390 00
JM082 007 1  3 14  1  140  380 00
JM082 008 1  1 13  1  170  395 00
JM082 009 1  7  4  3  120  344 00
JM082 010 1  7  4  1  130  332 00
JM082 011 1  2 14  1   80  289 00
JM082 012 1  3 14  1   30  254 00
JM082 013 1  1 14  1  420  270 00
JM082 014 1  7  1  1  490  229 00
JM082 015 1  1 14  1  300  134 00
JM082 016 1  2 14  2  300  184 00
JM082 017 1  1 14  1  760  216 00
JM082 018 1  1 14  1 1100  462 00
JM082 019 1  1 14  1 1140  470 00
JM082 020 1  7  3  1 1240  491 00
JM082 021 1  1 14  1 1350  720 00
JM082 022 1  1 14  5 1340  418 00
JM082 023 1  1 14  1 1200  276 00
JM082 024 1  2 14  1 1310  246 00
JM082 025 1  7  3  1 1550  373 00
JM082 026 1  7  4  1 1550  384 00
JM082 027 1  3 14  3 2080  479 00
JM082 028 1  1 14  1 2020  407 00
JM082 029 1  1 14  1 1980  422 00
JM082 030 1  2 14  1 1880  314 00
JM082 031 1  1 14  1 1960  160 00
JM082 032 1  2 14  1 2130  145 00
JM082 033 1  7  0  1 2240  217 00
JM082 034 1  1 14  1 2290  235 00
JM082 035 1  2 14  2 2300  334 00
JM082 036 1  7  0  1 2330  270 00
JM082 037 1  2 10  3 2420  284 00
JM082 038 1  3 14  1 2380  228 00
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Table 14.1 - continued

```
JM082 039 1  2 14  1 2660  253 00
JM082 040 1  0  0 15 2740  250 08
JM082 041 1  2 14  2 2760  216 00
JM082 042 1  7  1  2 2540  165 00
JM082 043 1  7  3  1 1800  162 00
JM082 044 1  7  1  2 1680  220 00
JM082 045 1  7  4  3 1680  166 00
JM082 046 1  2 14  1 1020   87 00
JM082 047 1  7  3  1  620   53 00
JM082 048 1  7  3  1  710   63 00
JM082 049 1  1 14  1 1710   71 00
JM082 050 1  1 14  8 2600   21 00
JM082 051 1  3 14  8 2900   19 00
JM082 052 1  7  3  1 2420  162 00
JM082 053 1  3 14  1 2360  243 00
JM082 054 1  3 14  1 2350  219 00
JM082 055 1  1 14  5 2250  209 00
JM082 056 1  7  0  1 2220  213 00
JM082 057 1  7  1  1 2240  160 00
JM082 058 1  2 14  1 1930  296 00
JM082 059 1  1 14  1 1970  318 00
JM082 060 1  2 14  3 2060  393 00
JM082 061 1  1 14  2 2100  464 00
JM082 062 1  2 14  1 2090  486 00
JM082 063 1  7  2  2 2070  491 00
JM082 064 1  0  0  0 1850  380 01
JM082 065 1  7  1  1 2710  336 00
JM082 066 1  7  4  1 2610  334 00
JM082 067 1  7  2 14 2500  477 00
JM082 068 1  2 14  1 2370  330 00
JM082 069 1  1 13  1 2350  338 00
JM082 070 1  2 14  1 2340  150 00
JM082 071 1  7  0  1 2100  226 00
JM082 072 1  2 14  1 1980  210 00
JM082 073 1  2 14  1 1450  214 00
JM082 074 1  1 14  1 1460  224 00
JM082 075 1  1 14  1 1340  280 00
JM082 076 1  3 14  1 1280  317 00
JM082 077 1  1 14  1 1270  320 00
JM082 078 1  7  1  1 1220  347 00
JM082 079 1  1 14  1  920  291 00
JM082 080 1  7  1  1  930  257 00
JM082 081 1  7  0  1  960  244 00
JM082 082 1  1 14  1 1000  220 00
JM082 083 1  7  1  1  950  212 00
JM082 084 1  2 13  1 1040  195 00
JM082 085 1  7  1  1  880  226 00
JM082 086 1  7  4  1  600   35 00
JM080 087 1  4 10  2  630   28 00
JM082 088 1  7  0  1  310  228 00
JM082 089 1  1 14  3  280  206 00
JM082 090 1  1 14  7  430  310 00
JM082 091 1  7  1  1  351   86 00
JM082 092 1  7  3  1  324  150 00
JM082 093 1  2 13  2 3280  154 00
JM082 094 1  1 14  1 2650  217 00
JM082 095 1  1 14  1 2540   62 00
JM082 096 1  0  0  0 3500   14 01
 1800 0500 1697 1156 0000 0000 047 065 000 064 096 000
JM082 006 2 050 050 1300 11765 06000 0091 03340 00137 00040 862 2 0800 23031000
JM082     3 667780 421766 02     122400    7 0078431 0027 0015 .10 .02 .13 .02    0
JM082     4    0 .57    0    0    0 .06    0    0    0    0    0    0 .06    0    0    0    0
```

Table 14.1 - continued

```
JM084 001 1  7  0  2 1790   88 00  34 000 0000078000 0 9
JM084 002 1  7  2  2 2000   66 00
JM084 003 1  7  3 14 1720  201 00
JM084 004 1  1 14  2 1700  218 00
JM084 005 1  7  1  2 1680  239 00
JM084 006 1  2  0  1 1630  264 00
JM084 007 1  2  0  3 1540  259 00
JM084 008 1  7  0  1 1510  244 00
JM084 009 1  2  0  1 1320  246 00
JM084 010 1  2  0  2 1700  281 00
JM084 011 1  1 14  1 1750  291 00
JM084 012 1  2  0  1 1760  266 00
JM084 013 1  4 13  2 1790  307 00
JM084 014 1  2  0  3 1850  305 00
JM084 015 1  2  0  1 1930  252 00
JM084 016 1  2  0  3 1800  354 00
JM084 017 1  7  4  1 1840  379 00
JM084 018 1  2  0  3 1850  394 00
JM084 019 1  2  0  3 1870  398 00
JM084 020 1  1  0  1 1900  484 00
JM084 021 1  3 14  1 1750  392 00
JM084 022 1  3 14  1 1690  332 00
JM084 023 1  3  0  3 1640  332 00
JM084 024 1  7  2  2 1900  133 00
JM084 025 1  2  0  3  590   86 00
JM084 026 1  2  0  2  310   92 00
JM084 027 1  7  3  1 1920   71 00
JM084 028 1  7  2 14 1700   31 00
JM084 029 1  4 13  1 1790  215 00
JM084 030 1  1  0  1 1740  214 00
JM084 031 1  1  0  3 1730  224 00
JM084 032 1  1  0  3 1640  221 00
JM084 033 1  2 14  1 1780  241 00
JM084 034 1  4 14  1 1800  266 00
 1660 0500 3170 0131 0000 0000 024 028 000 027 034 000
JM084 006 2 040 065 3100 11781 03340 0061 16000 00168 00000 690 2 0800 23031000
JM084      3 668840 421931 00     208000    9 0016346 0019 0006 .03 .09 .12   0   0
JM084      4    0 .18   0    0    0 .06 .12 .35 .03   0    0    0 .03   0    0    0    0
JM085 001 1  4 13  1 1630  204 00  80 000 0000272000 0 9
JM085 002 1  0 32 15 1450  292 00
JM085 003 1  3 14  1 1230  194 00
JM085 004 1  0 32 15 1190  319 00
JM085 005 1  1 14  1 1080  459 00
JM085 006 1  1  0  1  970  457 00
JM085 007 1  1  0  1  840  470 00
JM085 008 1  7  2  2  720  303 00
JM085 009 1  7  2  2  740  221 00
JM085 010 1  4 13  1  580  386 00
JM085 011 1  1  0  7  560  492 00
JM085 012 1  1  0  1  530  570 00
JM085 013 1  7  2  2  510  585 00
JM085 014 1  4 13  1  550  620 00
JM085 015 1  7  2  2  410  815 00
JM085 016 1  1 14  1  450  247 00
JM085 017 1  4 13  1  430  189 00
JM085 018 1  1  0  1  410  188 00
JM085 019 1  7  0  1  400  320 00
JM085 020 1  1 14  1  330  364 00
JM085 021 1  1  0  1  460  117 00
JM085 022 1  4 10  1  590  168 00
JM085 023 1  4 10  1  680   80 00
JM085 024 1  4 13  1  350   53 00
```

Table 14.1 - continued

```
JM085 025 1  7  0  1  110  235 00
JM085 026 1  7  1  1  160  206 00
JM085 027 1  4 13  1  960   29 00
JM085 028 1  4 14  8   70  217 00
JM085 029 1  4 13  1 3110   69 00
JM085 030 1  3 14  1 2980   80 00
JM085 031 1  1 14  1 2980   97 00
JM085 032 1  1 14  1 3300  161 00
JM085 033 1  4 10  1 2670   44 00
JM085 034 1  4 10  1 2660   57 00
JM085 035 1  4  0  3 3530  255 00
JM085 036 1  4 14  1 2450   60 00
JM085 037 1  4 13  1 2290  116 00
JM085 038 1  4 10  1 2590  186 00
JM085 039 1  7  2  2 2740  369 00
JM085 040 1  3 10  1 2280  281 00
JM085 041 1  3  0  1 2220  383 00
JM085 042 1  3 14  1 2230  413 00
JM085 043 1  7  0  1 2230  456 00
JM085 044 1  1 14  1 2290  580 00
JM085 045 1  7  3  2 2320  630 00
JM085 046 1  4 14  1 2380  433 00
JM085 047 1  3  0  1 2100  441 00
JM085 048 1  3 14  1 2060  444 00
JM085 049 1  1 14  1 1860  364 00
JM085 050 1  4 10  3 3460   76 00
JM085 051 1  4 14  1 3090   71 00
JM085 052 1  1  0  1 2980  191 00
JM085 053 1  7  0  1 3050  199 00
JM085 054 1  7  1  1 3170  397 00
JM085 055 1  1  0  1 3180  345 00
JM085 056 1  1  0  1 3560  420 00
JM085 057 1  1 14  1 3580  404 00
JM085 058 1  1 14  1  180  418 00
JM085 059 1  7  2  2  130  219 00
JM085 060 1  1  0  1 3510  249 00
JM085 061 1  7  0  1 3520  268 00
JM085 062 1  4 13  2 3470  270 00
JM085 063 1  1  0  1 3430  201 00
JM085 064 1  1  0  1    0  170 00
JM085 065 1  3  0  1  300  155 00
JM085 066 1  3 14  1 2720   83 00
JM085 067 1  4 13  1 2260   80 00
JM085 068 1  1  0  1 2290  106 00
JM085 069 1  1 14  1 2210  127 00
JM085 070 1  7  0  2 2270  288 00
JM085 071 1  1  0  1 2250  338 00
JM085 072 1  1 14  1 2290  510 00
JM085 073 1  4 13  1 2330  610 00
JM085 074 1  1 13  1 1880  125 00
JM085 075 1  3  0  1 1810  130 00
JM085 076 1  7  1  1 1740  143 00
JM085 077 1  4 13  1 1720  229 00
JM085 078 1  7  0  1 1790  590 00
JM085 079 1  1  0  1 1930  650 00
JM085 080 1  3  0  1 1960  640 00
 0180 1500 0000 0000 0000 0000 050 000 000 080 000 000
JM085 006 2 010 030 2020 11750 03000 0030 13330 00137 00000 687 2 0800 23031000
JM085     3 668860 421948 00    272000  10 0029411 0019 0006 .04 .08 .17 .09   0
JM085     4   0 .25   0   0   0 .09 .19   0 .06   0   0 .01   0   0 .03   0   0
JM086 001 1  4 13  1  400  505 00  81 000 0000095680 0 1
JM086 002 1  1  0  1  510  474 00
```

Table 14.1 - continued

JM086	003	1	1	14	1	840	361	00
JM086	004	1	1	14	1	900	391	00
JM086	005	1	7	3	14	1000	365	00
JM086	006	1	4	13	1	1070	333	00
JM086	007	1	1	0	1	600	166	00
JM085	008	1	2	0	3	540	125	00
JM086	009	1	1	0	1	540	108	00
JM086	010	1	1	0	1	430	163	00
JM086	011	1	4	13	1	350	232	00
JM086	012	1	1	14	1	300	258	00
JM086	013	1	1	14	2	300	271	00
JM086	014	1	7	0	2	300	477	00
JM086	015	1	2	14	1	280	469	00
JM086	016	1	1	14	2	150	419	00
JM086	017	1	1	0	1	150	391	00
JM086	018	1	1	14	1	240	189	00
JM086	019	1	1	0	1	380	134	00
JM086	020	1	2	14	1	250	98	00
JM086	021	1	1	14	1	170	90	00
JM086	022	1	2	14	3	100	110	00
JM086	023	1	1	0	1	140	124	00
JM086	024	1	1	0	1	130	157	00
JM086	025	1	7	0	3	130	162	00
JM086	026	1	2	0	1	130	166	00
JM086	027	1	1	0	1	170	185	00
JM086	028	1	7	0	3	40	370	00
JM086	029	1	1	0	2	0	496	00
JM086	030	1	2	0	3	3570	500	00
JM086	031	1	1	14	1	3500	327	00
JM086	032	1	4	13	1	3490	256	00
JM086	033	1	1	0	1	3490	610	00
JM086	034	1	1	0	1	3570	101	00
JM086	035	1	1	14	1	20	58	00
JM086	036	1	1	0	1	3430	40	00
JM086	037	1	1	14	1	3210	124	00
JM086	038	1	2	14	1	3400	152	00
JM086	039	1	1	0	1	3390	289	00
JM086	040	1	2	14	1	3300	262	00
JM086	041	1	2	14	1	3120	378	00
JM086	042	1	1	0	1	3130	252	00
JM086	043	1	1	0	1	3090	146	00
JM086	044	1	1	14	1	3040	151	00
JM086	045	1	1	14	1	3050	166	00
JM086	046	1	4	13	1	3040	227	00
JM086	047	1	7	0	1	3080	363	00
JM086	048	1	1	14	1	2960	520	00
JM086	049	1	1	0	1	2910	429	00
JM086	050	1	1	14	1	2850	455	00
JM086	051	1	1	14	1	2900	540	00
JM086	052	1	2	14	1	2820	289	00
JM086	053	1	2	14	1	2830	229	00
JM086	054	1	2	14	1	2670	82	00
JM086	055	1	1	14	1	2120	64	00
JM086	056	1	1	14	1	2230	81	00
JM086	057	1	2	0	1	2050	265	00
JM086	058	1	1	14	1	2030	253	00
JM086	059	1	2	14	1	2030	247	00
JM086	060	1	4	13	1	2030	243	00
JM086	061	1	2	14	1	1920	306	00
JM086	062	1	2	0	3	1920	244	00
JM086	063	1	2	14	1	1950	189	00
JM086	064	1	4	13	1	1830	287	00

Table 14.1 - continued

JM086	065	1	1	0	1	1790	285	00											
JM086	066	1	2	14	2	1770	235	00											
JM086	067	1	4	13	1	1700	419	00											
JM086	068	1	1	0	1	1660	325	00											
JM086	069	1	1	14	1	1600	434	00											
JM086	070	1	1	14	1	1750	174	00											
JM086	071	1	4	13	1	1860	145	00											
JM086	072	1	1	14	1	1510	203	00											
JM086	073	1	1	14	1	1440	337	00											
JM086	074	1	2	0	1	1300	223	00											
JM086	075	1	1	14	1	1310	201	00											
JM086	076	1	7	0	1	1230	179	00											
JM086	077	1	1	14	1	1210	19	00											
JM086	078	1	4	13	1	1140	206	00											
JM086	079	1	2	14	1	1150	303	00											
JM086	080	1	7	1	1	1110	392	00											
JM086	081	1	7	2	1	1100	242	00											
JM086	006	2	015	050	1800	11795	10340	0107	12000	00182	00350	948	2	0800	23031000				
JM086		3	669320	421825	00	095680	7	0084657	0019	0012	.01	.01	.14	0	0				
JM086		4	0	.47	0	0	0	.06	.23	.07	0	0	0	0	0	0	0	0	0
JM087	001	1	4	0	3	1560	46	00	92	000	0000073920	0	9						
JM087	002	1	4	13	1	1560	46	00											
JM087	003	1	4	13	2	1490	65	00											
JM087	004	1	4	0	3	1500	67	00											
JM087	005	1	1	0	1	1290	58	00											
JM087	006	1	0	32	1	1180	60	00											
JM087	007	1	3	14	1	1020	129	00											
JM087	008	1	7	1	1	960	137	00											
JM087	009	1	3	14	1	970	141	00											
JM087	010	1	1	0	1	750	106	00											
JM087	011	1	1	14	3	550	47	00											
JM087	012	1	1	0	1	480	52	00											
JM087	013	1	1	14	1	3480	91	00											
JM087	014	1	7	1	2	3560	81	00											
JM087	015	1	1	0	1	190	141	00											
JM087	016	1	1	14	1	3500	171	00											
JM087	017	1	1	0	3	3300	96	00											
JM087	018	1	1	0	1	3210	168	00											
JM087	019	1	4	13	1	3210	192	00											
JM087	020	1	7	0	1	3160	196	00											
JM087	021	1	1	14	3	3170	240	00											
JM087	022	1	3	14	1	3190	242	00											
JM087	023	1	4	13	1	3340	275	00											
JM087	024	1	3	0	3	3330	330	00											
JM087	025	1	1	0	3	3350	349	00											
JM087	026	1	4	13	1	3380	325	00											
JM087	027	1	1	14	1	3550	214	00											
JM087	028	1	1	14	3	3580	232	00											
JM087	029	1	3	14	3	2580	67	00											
JM087	030	1	1	0	1	2590	71	00											
JM087	031	1	4	13	2	2880	122	00											
JM087	032	1	4	13	1	2960	144	00											
JM087	033	1	3	0	1	2800	157	00											
JM087	034	1	4	13	1	2040	50	00											
JM087	035	1	7	0	1	2080	61	00											
JM087	036	1	7	0	1	2080	61	00											
JM087	037	1	3	14	1	1920	64	00											
JM087	038	1	3	14	1	2150	74	00											
JM087	039	1	4	14	1	2190	71	00											
JM087	040	1	1	0	1	2430	113	00											
JM087	041	1	1	14	1	2350	116	00											
JM087	042	1	1	0	1	2470	145	00											

Table 14.1 - continued

```
JM087 043 1  1  0  3 2540  144 00
JM087 044 1  1  0  1 2580  126 00
JM087 045 1  7  0  1 2300  174 00
JM087 046 1  1  0  1 2390  171 00
JM087 047 1  2 14  1 2150  128 00
JM087 048 1  4 13  0 1880  249 00
JM087 049 1  2  0  1  140   40 00
JM087 050 1  1  0  5  480   68 00
JM087 051 1  7  1  1  170  124 00
JM087 052 1  1  0  1 3370  150 00
JM087 053 1  1  0  1 3350  162 00
JM087 054 1  2  0  1 3350  176 00
JM087 055 1  1  0  1 3330  191 00
JM087 056 1  1  0  1 3370  203 00
JM087 057 1  0  0  2 3270  200 01
JM087 058 1  4  0 15 3240  220 00
JM087 059 1  1 16  1 3230  218 00
JM087 060 1  1  0  3 3170  211 00
JM087 061 1  4 13  1 3140  214 00
JM087 062 1  1  0  1 2990  225 00
JM087 063 1  1  0  1 2930  269 00
JM087 064 1  1  0  1 2900  265 00
JM087 065 1  1  0  1 2860  238 00
JM087 066 1  7  0  1 2820  236 00
JM087 067 1  4 13  1 2820  169 00
JM087 068 1  1  0  1 2740  118 00
JM087 069 1  7  0  2 2800   91 00
JM087 070 1  4 13  1 2350   25 00
JM087 071 1  2 14  1 2190   33 00
JM087 072 1  4 13  1 1800   37 00
JM087 073 1  1 14  1 1940   74 00
JM087 074 1  1 14  1 2040  142 00
JM087 075 1  1 14  1 1770  231 00
JM087 076 1  4 13  1 1760  242 00
JM087 077 1  2 14  1 1800  257 00
JM087 078 1  2  0  1 1820  296 00
JM087 079 1  1  0  3 1820  308 00
JM087 080 1  4 13  2 1790  280 00
JM087 081 1  4 13  1 1650  327 00
JM087 082 1  2 14  1 1540  256 00
JM087 083 1  1  0  1 1700  195 00
JM087 084 1  1  0  1 1740   57 00
JM087 085 1  1  0  1 1550   13 00
JM087 086 1  7  1  1 1120  256 00
JM087 087 1  1 14  1 1000  344 00
JM087 088 1  3 14  3  990  350 00
JM087 089 1  4 10  3  990  325 00
JM087 090 1  7  1  1  950  181 00
JM087 091 1  3 14  1  830  223 00
JM087 092 1  3 14  3  870  138 00
 1220 0900 0000 0000 0000 0000 049 000 000 092 000 000
JM087 064 2 015 040 2050 11750 03000 0076 10000 00137 00360 905 2 0800 02133030
JM087     3 669810 421798 01     073920  10 0124458 0029 0011 .05   0 .17 .01   0
JM087     4    0 .27   0    0    0 .07 .30 .03 .02   0   0 .03   0   0 .01   0   0
JM088 001 1  4 10  3 1460  134 00   92 000 0000086400 0 9
JM088 002 1  1  0  1 1400  151 00
JM088 003 1  2  0  1 1380  146 00
JM088 004 1  7  0  3 1510  219 00
JM088 005 1  2  0  1 1600  242 00
JM088 006 1  3  0  1 1580  268 00
JM088 007 1  7  0  1 1470  478 00
JM088 008 1  2  0  1 1390  479 00
```

Table 14.1 - continued

JM088	009	1	2	0	2	1410	379	00
JM088	010	1	2	0	1	1280	390	00
JM088	011	1	4	10	2	1190	324	00
JM088	012	1	4	13	1	1120	342	00
JM088	013	1	4	10	1	1110	345	00
JM088	014	1	2	0	1	1080	372	00
JM088	015	1	7	0	2	1040	356	00
JM088	016	1	2	0	1	1000	364	00
JM088	017	1	1	0	1	1220	261	00
JM088	018	1	4	15	1	1790	123	00
JM088	019	1	4	13	1	1860	87	00
JM088	020	1	1	0	6	1990	156	00
JM088	021	1	4	13	3	1990	156	00
JM088	022	1	3	0	3	2060	239	00
JM088	023	1	7	0	1	2300	192	00
JM088	024	1	2	0	1	2340	188	00
JM088	025	1	3	0	3	2320	223	00
JM088	026	1	2	0	2	2430	215	00
JM088	027	1	2	0	1	2500	227	00
JM088	028	1	7	0	1	2490	169	00
JM088	029	1	7	0	1	2700	227	00
JM088	030	1	1	0	1	2700	286	00
JM088	031	1	1	0	1	2750	299	00
JM088	032	1	7	0	1	2760	284	00
JM088	033	1	7	2	2	2740	333	00
JM088	034	1	2	0	2	2660	415	00
JM088	035	1	4	10	1	2660	430	00
JM088	036	1	1	0	1	2740	520	00
JM088	037	1	2	0	1	2780	452	00
JM088	038	1	2	0	3	2820	479	00
JM088	039	1	2	0	3	2900	270	00
JM088	040	1	1	0	1	3030	278	00
JM088	041	1	2	0	2	3040	287	00
JM088	042	1	1	0	3	3050	349	00
JM088	043	1	7	0	2	3120	395	00
JM088	044	1	7	0	2	3130	385	00
JM088	045	1	4	13	1	3160	365	00
JM088	046	1	4	13	1	3200	256	00
JM088	047	1	1	0	3	3170	187	00
JM088	048	1	4	10	2	2950	189	00
JM088	049	1	2	0	3	2770	49	00
JM088	050	1	0	0	0	3550	188	01
JM088	051	1	3	0	3	300	159	00
JM088	052	1	7	0	2	370	105	00
JM088	053	1	0	0	0	810	183	01
JM088	054	1	0	0	0	1210	100	01
JM088	055	1	4	10	1	1250	58	00
JM088	056	1	0	0	0	1240	67	01
JM088	057	1	7	0	3	1240	205	00
JM088	058	1	7	0	3	1240	205	00
JM088	059	1	2	0	3	1230	232	00
JM088	060	1	1	0	2	1230	258	00
JM088	061	1	1	0	1	1210	236	00
JM088	062	1	7	0	2	1010	107	00
JM088	063	1	0	0	0	540	47	01
JM088	064	1	0	0	0	130	81	01
JM088	065	1	2	0	1	180	80	00
JM088	066	1	2	0	1	3490	71	00
JM088	067	1	1	0	3	3440	67	00
JM088	068	1	3	0	3	3390	145	00
JM088	069	1	1	0	1	10	252	00
JM088	070	1	7	2	2	40	373	00

Table 14.1 - continued

```
JM088 071 1  7  0  1   30  550 00
JM088 072 1  7  0  2   70  479 00
JM088 073 1  7  0  1  160  415 00
JM088 074 1  7  0  1  160  415 00
JM088 075 1  1  0  1  160  415 00
JM088 076 1  4 10  1  230  473 00
JM088 077 1  4 10  1  230  464 00
JM088 078 1  7  0  1  340  232 00
JM088 079 1  2  0  1  340  223 00
JM088 080 1  4 10  1  380  183 00
JM088 081 1  1  0  1  300  123 00
JM088 082 1  1  0  2  320  120 00
JM088 083 1  4 10  1 3010  161 00
JM088 084 1  7  0  1 2960  232 00
JM088 085 1  2  0  2 2740  300 00
JM088 086 1  7  0  1 2640  268 00
JM088 087 1  1  0  1 1970   54 00
JM088 088 1  4 10  1 2160   88 00
JM088 089 1  2  0  2 2200  130 00
JM088 090 1  2  0  1 2200  146 00
JM088 091 1  7  0  3 2160  199 00
JM088 092 1  2  0  1 3150  355 00
 1230 0770 0000 0000 0000 0000 055 000 000 092 000 000
JM088 064 2 010 040 2200 11765 01670 0076 04000 00158 00420 933 2 0800 02133030
JM088     3 670400 421783 02    086400    7 0106481 0038 0017   0 .02 .05 .12   0
JM088     4    0    0 .01    0    0 .23 .18 .26 .05    0    0    0    0    0    0    0    0
JM089 001 1  7  0  3   60  654 00  52 000 0000057600 0 1
JM089 002 1  4 13  2 3370  371 00
JM089 003 1  1 14  1 3390  407 00
JM089 004 1  1 14  1 3520  335 00
JM089 005 1  7  3 14   10  362 00
JM089 006 1  7  0  3   10  249 00
JM089 007 1  1 14  1   40  241 00
JM089 008 1  7  1  1   90  253 00
JM089 009 1  7  0  3   70  217 00
JM089 010 1  4 13  2  110  311 00
JM089 011 1  7  0  3   70  387 00
JM089 012 1  1  0  1  110  456 00
JM089 013 1  1 14  7  200  318 00
JM089 014 1  7  0  3  190  305 00
JM089 015 1  7  0  3  200  304 00
JM089 016 1  4 13  1  930  104 00
JM089 017 1  4 13  1 1140  104 00
JM089 018 1  1  0  1 1160   53 00
JM089 019 1  4 13  1 1200  146 00
JM089 020 1  1 14  1 1280  132 00
JM089 021 1  4 13  1 1570  148 00
JM089 022 1  7  0  1 1730  156 00
JM089 023 1  1 14  1 1700  139 00
JM089 024 1  1 14  1 1730  108 00
JM089 025 1  4 13  1 1830  151 00
JM089 026 1  1 14  1 1810  125 00
JM089 027 1  4 13 15 1820   86 00
JM089 028 1  7  3 14 1860  136 00
JM089 029 1  7  0  2 1950  146 00
JM089 030 1  7  1  1 1950  131 00
JM089 031 1  1 14  1 1930   81 00
JM089 032 1  1 14  3 1900   55 00
JM089 033 1  7  1  2 1900   26 00
JM089 034 1  1 14 15 2090   64 00
JM089 035 1  7  2  2 2010   55 00
JM089 036 1  7  0  1 2150   62 00
```

Table 14.1 - continued

```
JM089 037 1   1  14  15 2150   127 00
JM088 038 1   4  13   1 2340    55 00
JM089 039 1   4  13   2 2380    58 00
JM089 040 1   1  14   1 2410    61 00
JM089 041 1   1  14   1 2350    99 00
JM089 042 1   1  14   1 2770   145 00
JM089 043 1   4  13   1 2800   183 00
JM089 044 1   4  13   2 2810   220 00
JM089 045 1   7   0   2 2790   255 00
JM089 046 1   7   1   1 2840   269 00
JM089 047 1   4  13   1 2910   269 00
JM089 048 1   4  13   1 2960   334 00
JM089 049 1   4  13   1 3060   389 00
JM089 050 1   7   0   2 3110   315 00
JM089 051 1   1  14   1 3120   164 00
JM089 052 1   7   0   3 3100    61 00
JM089 064 2 100 225 1500 11771 01670 0006 02170 00158 00260 816 2 0800 02133030
JM089     3 670560 421791 00     057600   6 0090277 0048 0018 .08 .02 .33   0   0
JM089     4   0 .31   0   0   0 .23 .04   0   0   0   0   0   0   0   0   0   0
JM090 001 1   7   0   1  910    19 00  93 000 0000030000 0 1
JM090 002 1   1   0   1  530    42 00
JM090 003 1   1   0   1  320    44 00
JM090 004 1   7   0   1  440    76 00
JM090 005 1   7   0   3  410   331 00
JM090 006 1   2   0   1  690   152 00
JM090 007 1   2   0   3  740   147 00
JM090 008 1   4  10   2  750   110 00
JM090 009 1   1   0   1  700    74 00
JM090 010 1   3   0   3  820    99 00
JM090 011 1   7   0   1  850   111 00
JM090 012 1   1   0   3  870   107 00
JM090 013 1   2   0   3  940   109 00
JM090 014 1   7   0   3  940   104 00
JM090 015 1   2   0   2  930   100 00
JM090 016 1   7   0   3  910    85 00
JM090 017 1   1   0   1  840    47 00
JM090 018 1   7   0   1  980   194 00
JM090 019 1   4  10   2 1000   201 00
JM090 020 1   7   0   3 1020   118 00
JM090 021 1   4  10   1 1010    65 00
JM090 022 1   1   0   1 1050    83 00
JM090 023 1   2   0   1 1060   138 00
JM090 024 1   2   0   3 1060   120 00
JM090 025 1   2   0   3 1120   151 00
JM090 026 1   7   0   3 1120   146 00
JM090 027 1   1   0   1 1100   129 00
JM090 028 1   2   0   3 1100   129 00
JM090 029 1   1   0   3 1120   114 00
JM090 030 1   4  10   2 1130    62 00
JM090 031 1   4  10   2 1110    44 00
JM090 032 1   2   0   1 1220    24 00
JM090 033 1   1   0   1 1240    42 00
JM090 034 1   2   0   3 1220    52 00
JM090 035 1   1   0   1 1150    82 00
JM090 036 1   7   0   3 1150   258 00
JM090 037 1   4  13   3 1160   141 00
JM090 038 1   7   0   1 1160   125 00
JM090 039 1   1   0   1 1170   107 00
JM090 040 1   2   0   1 1190   103 00
JM090 041 1   1   0   1 1220    91 00
JM090 042 1   7   0   1 1340    52 00
JM090 043 1   7   0   1 1390    49 00
```

Table 14.1 - continued

JM090	044	1	7	0	1	1390	49	00											
JM090	045	1	7	0	1	1430	38	00											
JM090	046	1	1	0	1	1450	43	00											
JM090	047	1	2	0	1	1230	251	00											
JM090	048	1	7	2	2	1240	253	00											
JM090	049	1	1	0	3	1320	242	00											
JM090	050	1	1	0	1	1320	240	00											
JM090	051	1	2	0	1	1320	217	00											
JM090	052	1	4	10	1	1340	223	00											
JM090	053	1	4	10	1	1340	142	00											
JM090	054	1	1	0	1	1250	139	00											
JM090	055	1	7	0	3	1320	109	00											
JM090	056	1	4	13	2	1310	101	00											
JM090	057	1	2	0	3	1400	108	00											
JM090	058	1	7	0	3	1460	139	00											
JM090	059	1	7	0	1	1520	96	00											
JM090	060	1	4	10	1	1590	158	00											
JM090	061	1	7	0	3	1550	476	00											
JM090	062	1	7	2	2	1560	478	00											
JM090	063	1	4	10	1	1600	443	00											
JM090	064	1	7	0	3	1360	432	00											
JM090	065	1	7	0	3	1330	384	00											
JM090	066	1	7	2	2	1720	318	00											
JM090	067	1	4	10	1	1730	317	00											
JM090	068	1	7	0	2	1740	308	00											
JM090	069	1	7	0	3	1780	193	00											
JM090	070	1	1	0	1	1820	161	00											
JM090	071	1	7	0	1	1670	137	00											
JM090	072	1	1	0	1	1640	123	00											
JM090	073	1	2	0	1	1600	125	00											
JM090	074	1	7	0	1	1630	62	00											
JM090	075	1	2	0	1	1690	52	00											
JM090	076	1	3	0	1	1870	68	00											
JM090	077	1	2	0	1	1890	152	00											
JM090	078	1	2	0	1	1950	197	00											
JM090	079	1	4	10	1	1990	248	00											
JM090	080	1	2	0	1	2000	309	00											
JM090	081	1	1	0	1	2150	205	00											
JM090	082	1	7	0	1	2040	75	00											
JM090	083	1	7	0	1	2090	68	00											
JM090	084	1	7	0	1	2260	92	00											
JM090	085	1	4	10	1	2210	153	00											
JM090	086	1	2	0	1	2260	171	00											
JM090	087	1	1	0	1	2280	187	00											
JM090	088	1	7	0	3	2410	386	00											
JM090	089	1	4	10	1	2320	155	00											
JM090	090	1	4	13	1	2660	150	00											
JM090	091	1	4	10	1	3270	147	00											
JM090	092	1	1	0	3	3300	107	00											
JM090	093	1	7	0	1	3240	91	00											
JM090	064	2	080	225	2000	11750	11720	0030	02600	00137	00280	882	2	0800	02133030				
JM090		3	670670	421777	00	030000	6	0310000	0048	0018	0	.03	.03	.15	0				
JM090		4	0	0	0	0	0	.32	.23	.22	.02	0	0	0	0	0	0	0	0
JM091	001	1	7	0	1	1580	22	00	79	000	0000025000	0	1						
JM091	002	1	3	0	1	1590	94	00											
JM091	003	1	1	0	1	1650	106	00											
JM091	004	1	7	0	1	1560	134	00											
JM091	005	1	2	0	11	1710	108	00											
JM091	006	1	2	0	1	1750	86	00											
JM091	007	1	7	3	1	1840	93	00											
JM091	008	1	1	0	1	1780	179	00											
JM091	009	1	7	0	3	1830	171	00											

Table 14.1 - continued

JM091	010	1	7	0	3	1830	260	00
JM091	011	1	4	10	1	1680	270	00
JM091	012	1	4	10	1	1840	338	00
JM091	013	1	7	0	1	1880	326	00
JM091	014	1	7	0	3	1990	327	00
JM091	015	1	4	10	3	1890	267	00
JM091	016	1	4	10	1	1890	267	00
JM091	017	1	3	0	1	1950	275	00
JM091	018	1	4	13	1	2010	274	00
JM091	019	1	4	13	1	2010	274	00
JM091	020	1	4	13	1	2000	293	00
JM091	021	1	4	13	1	2030	305	00
JM091	022	1	7	0	3	2040	350	00
JM091	023	1	2	0	2	2040	360	00
JM091	024	1	4	13	1	2020	146	00
JM091	025	1	7	0	1	2130	178	00
JM091	026	1	3	0	1	2130	178	00
JM091	027	1	3	0	1	2130	178	00
JM091	028	1	2	0	3	2110	127	00
JM091	029	1	1	0	1	2170	110	00
JM091	030	1	4	13	1	2220	185	00
JM091	031	1	7	0	1	2220	213	00
JM091	032	1	4	10	1	2190	84	00
JM091	033	1	7	0	1	2270	77	00
JM091	034	1	7	0	2	2130	35	00
JM091	035	1	7	0	3	2430	76	00
JM091	036	1	7	0	1	2430	225	00
JM091	037	1	4	13	1	2480	200	00
JM091	038	1	7	0	1	2630	176	00
JM091	039	1	7	0	1	2650	186	00
JM091	040	1	7	0	1	2670	187	00
JM091	041	1	7	0	1	2700	181	00
JM091	042	1	7	0	1	2740	180	00
JM091	043	1	2	0	1	2710	148	00
JM091	044	1	7	0	3	2800	169	00
JM091	045	1	2	0	1	2690	68	00
JM091	046	1	1	0	1	2860	62	00
JM091	047	1	1	0	1	2940	134	00
JM091	048	1	2	0	3	2990	21	00
JM091	049	1	7	0	3	3100	72	00
JM091	050	1	7	0	2	140	154	00
JM091	051	1	2	0	3	410	85	00
JM091	052	1	7	0	3	620	140	00
JM091	053	1	2	0	1	730	158	00
JM091	054	1	7	0	3	750	164	00
JM091	055	1	1	0	1	800	168	00
JM091	056	1	7	0	1	820	246	00
JM091	057	1	1	0	1	840	247	00
JM091	058	1	7	0	1	850	243	00
JM091	059	1	7	0	1	860	264	00
JM091	060	1	7	0	2	830	203	00
JM091	061	1	1	0	2	880	158	00
JM091	062	1	7	0	2	740	62	00
JM091	063	1	1	0	1	720	69	00
JM091	064	1	2	0	3	630	70	00
JM091	065	1	2	0	1	1290	56	00
JM091	066	1	2	0	1	940	278	00
JM091	067	1	7	0	1	1040	254	00
JM091	068	1	4	13	3	980	326	00
JM091	069	1	7	0	2	1180	299	00
JM091	070	1	7	0	1	1190	303	00
JM091	071	1	7	0	2	1210	317	00

Table 14.1 - continued

```
JM091 072 1  4 13  1 1220  318 00
JM091 073 1  7  0  6 1250  327 00
JM091 074 1  7  0  3 1400  315 00
JM091 075 1  4 13  3 1320  231 00
JM091 076 1  1  0  1 1390  173 00
JM091 077 1  1  0  1 1220  184 00
JM091 078 1  1  0  1 1230  140 00
JM091 079 1  4 13  1  830   19 00
JM091 064 2 050 125 2300 11741 00400 0021 02830 00128 00160 825 2 0800 02133030
JM091     3 670850 421777 00    025000   6 0316000 0048 0017   0   0 .15 .06   0
JM091     4   0   0   0   0   0 .43 .15 .15 .05   0   0   0   0   0   0   0   0
JM092 001 1  7  0  1 3450  453 00  87 000 0000040560 0 1
JM092 002 1  4 14  1 3460  440 00
JM092 003 1  2  0  2 3410  422 00
JM092 004 1  1 13  1 3370  381 00
JM092 005 1  1  0  1 3330  372 00
JM092 006 1  7  0  3 3360  265 00
JM092 007 1  4 13  0 3370  264 00
JM092 008 1  1  0  1 3400  251 00
JM092 009 1  1 14  1 3420  252 00
JM092 010 1  2  0  1 3430  255 00
JM092 011 1  1  0  1 3410  319 00
JM092 012 1  1 14  1 3350  286 00
JM092 013 1  2  0  1 3350  276 00
JM092 014 1  2 14  1 3380  271 00
JM092 015 1  3 14  1 3240  338 00
JM092 016 1  7  0  1 3240  333 00
JM092 017 1  1 14  1 3230  307 00
JM092 018 1  4 13  1 3260  299 00
JM092 019 1  3 14  5 3330  258 00
JM092 020 1  7  0  3 3300  232 00
JM092 021 1  7  1  1 3370  199 00
JM092 022 1  7  0  1 3360  206 00
JM092 023 1  7  0  1 3130  321 00
JM092 024 1  1 14  1 3140  272 00
JM092 025 1  3 14  1 3110  299 00
JM092 026 1  1  0  1 3090  292 00
JM092 027 1  4 13  1 3070  284 00
JM092 028 1  1  0  3 3100  270 00
JM092 029 1  3 14  1 3090  259 00
JM092 030 1  1  0  2 3100  245 00
JM092 031 1  2 14  2 3100  179 00
JM092 032 1  1 13  0 3140  202 00
JM091 033 1  7  0  3 3140  183 00
JM092 034 1  4 13  1 3150  172 00
JM092 035 1  2 14  1 3170  161 00
JM092 036 1  4  0  3 3220  162 00
JM092 037 1  1  0  3 3250  155 00
JM092 038 1  1 14  1 3450  157 00
JM092 039 1  1 14  1 3420  126 00
JM092 040 1  4 10  1 3170  174 00
JM092 041 1  1  0  1 3010  211 00
JM092 042 1  1  0  3 3000  204 00
JM092 043 1  7  1  1 3020  206 00
JM092 044 1  2 14  1 3040  232 00
JM092 045 1  3 14  1 3030  232 00
JM092 046 1  3 14  1 3030  224 00
JM092 047 1  3 14  1 3030  218 00
JM092 048 1  2 14  1 3060  243 00
JM092 049 1  1 14  3 3060  236 00
JM092 050 1  7  0  1 3040  217 00
JM092 051 1  4 13  0 3070  189 00
```

Table 14.1 - continued

```
JM092 052 1  1  0  1 3080   157 00
JM092 053 1  3  0  1 2910   231 00
JM092 054 1  7  0  1 2910   225 00
JM092 055 1  1  0  2 2890   192 00
JM092 056 1  1  0  3 2890   204 00
JM092 057 1  3 14  1 2860   235 00
JM092 058 1  7  2  2 2810   169 00
JM092 059 1  1  0  3 2720   194 00
JM092 060 1  1 14  1 2710   166 00
JM092 061 1  1 14  2 2690   168 00
JM092 062 1  3 14  1 2720   146 00
JM092 063 1  3 14  5 2750   158 00
JM092 064 1  3 14  3 2600   179 00
JM092 065 1  2  0  3 2640   180 00
JM092 066 1  2  0  3 2650   168 00
JM092 067 1  2  0  1 2660   186 00
JM092 068 1  4 13  2 2560   143 00
JM092 069 1  3 14  3 2550   148 00
JM092 070 1  4 13  2 2450   138 00
JM092 071 1  3 14  1 2450    64 00
JM092 072 1  1  0  3 2510    71 00
JM092 073 1  3  0  3 2500    57 00
JM092 074 1  1  0  1 1890   156 00
JM092 075 1  4 13  1 1800   143 00
JM092 076 1  7  2  2 1740   154 00
JM092 077 1  3  0  1 1560   144 00
JM092 078 1  4 13  2 1450   249 00
JM092 079 1  7  1  1 1200   319 00
JM092 080 1  2 14  1 1230   261 00
JM092 081 1  3 14  1 1200   131 00
JM092 082 1  2  0  1 1350    73 00
JM092 083 1  1 13  3 1210    53 00
JM092 084 1  7  0  1  900    76 00
JM092 085 1  3 14  1  790    98 00
JM092 086 1  3  0  1  740    86 00
JM092 087 1  3 14  1  680    70 00
JM092 064 2 015 075 2000 11750 01300 0030 02830 00139 00150 787 2 0800 02133030
JM092     3 670970 421775 00    040560   9 0214497 0048 0017 .03 .02 .14 .01   0
JM092     4   0 .37   0   0   0 .11 .17 .08 .05   0   0 .01   0   0   0   0   0
JM093 001 1  1  0  3 2060   170 00  51 000 0000015600 0 1
JM093 002 1  2  0  1 1830   162 00
JM093 003 1  7  0  6 1300   103 00
JM093 004 1  1  0  3 1200    87 00
JM093 005 1  2  0  1 1210    84 00
JM093 006 1  2  0  3  850    95 00
JM093 007 1  1  0  3  790    91 00
JM093 008 1  4 13  1  720   144 00
JM093 009 1  7  0  3  700   148 00
JM093 010 1  4 13  1  450   140 00
JM093 011 1  4 13  1  450   140 00
JM093 012 1  2  0  3  300   128 00
JM093 013 1  7  0  1  260   286 00
JM093 014 1  3  0  2  180   261 00
JM093 015 1  3  0  1  180   237 00
JM093 016 1  4 13  3  160   206 00
JM093 017 1  7  0  1   60   213 00
JM093 018 1  7  0  1   50   187 00
JM093 019 1  7  0  2   30   164 00
JM093 020 1  7  0  2   20   127 00
JM093 021 1  2  0  1  100   123 00
JM093 022 1  7  0  2   40    93 00
JM093 023 1  7  0  2  270    93 00
```

Table 14.1 - continued

```
JM093 024 1  1  0  1 3570    67 00
JM093 025 1  7  0  2 3430    63 00
JM093 026 1  7  0  3 3500   134 00
JM093 027 1  7  0  1 3590   159 00
JM093 028 1  2  0  1 3550   160 00
JM093 029 1  2  0  1 3570   325 00
JM093 030 1  2  0  3 3500   345 00
JM093 031 1  7  0  1 3410   338 00
JM093 032 1  2  0  1 3360   368 00
JM093 033 1  2  0  1 3370   255 00
JM093 034 1  1  0  1 3310   304 00
JM093 035 1  1  0  1 3210   132 00
JM093 036 1  1  0  2 3260    96 00
JM093 037 1  4 13  6 3340    74 00
JM093 038 1  7  0  1 3050    85 00
JM093 039 1  7  0  2 2870    86 00
JM093 040 1  7  0  3 2860    82 00
JM093 041 1  1  0  1 2890    58 00
JM093 042 1  3  0  3 3000    33 00
JM093 043 1  7  0  3 2980    33 00
JM093 044 1  7  0  1 3250    26 00
JM093 045 1  1  0  1 3000    17 00
JM093 046 1  2  0  1 2520    59 00
JM093 047 1  1  0  1 2600   121 00
JM093 048 1  1  0  1 2330   163 00
JM093 049 1  1  0  1 2210   116 00
JM093 050 1  7  0  1 2230    90 00
JM093 051 1  7  0  1  600   265 00
JM093 006 2 050 050 1000 11759 02800 0094 05000 00155 00140 793 2 0800 23031000
JM093     3 671400 421792 00    015600   4 0326923 0038 0016    0    0 .10    0    0
JM093     4    0    0    0    0    0 .39 .24 .22 .06    0    0    0    0    0    0    0    0
JM094 001 1  7  0  3  630    50 00  56 000 10500 0 1
JM094 002 1  1  0  1  530   108 00
JM094 003 1  7  0  3  760   164 00
JM094 004 1  4 10  1  680   220 00
JM094 005 1  1  0  1  980   298 00
JM094 006 1  4 13  2  960   156 00
JM094 007 1  2  0  2  930   140 00
JM094 008 1  7  0  2 1120   233 00
JM094 009 1  4 10  1 1230   272 00
JM094 010 1  7  0  1 1220   211 00
JM094 011 1  4 10  1 1210   202 00
JM094 012 1  7  0  1 1240   202 00
JM094 013 1  7  0  1 1120   111 00
JM094 014 1  7  2  2 1220    74 00
JM094 015 1  4 13  1 1280    82 00
JM094 016 1  1  0  2 1260   131 00
JM094 017 1  1  0  1 1270   129 00
JM094 018 1  7  0  2 1290   130 00
JM094 019 1  4 10  1 1260   155 00
JM094 020 1  2  0  1 1290   137 00
JM094 021 1  2  0  1 1290   137 00
JM094 022 1  7  0  3 1320   139 00
JM094 023 1  4 10  2 1320   143 00
JM094 024 1  7  0  2 1260   230 00
JM094 025 1  4 10  1 1290   219 00
JM094 026 1  2  0  1 1310   293 00
JM094 027 1  7  0  1 1460   259 00
JM094 028 1  1  0  1 1470   226 00
JM094 029 1  7  0  1 1490   153 00
JM094 030 1  1  0  1 1480   161 00
JM094 031 1  7  0  2 1470   136 00
```

Table 14.1 - continued

```
JM094 032 1  1  0  1 1480  130 00
JM094 033 1  7  2  2 1370  113 00
JM094 034 1  7  2  2 1440  115 00
JM094 035 1  7  0  2 1540  119 00
JM094 036 1  2  0  3 1720  129 00
JM094 037 1  4 13  1 1720  130 00
JM094 038 1  7  0  1 1770  107 00
JM094 039 1  2  0  2 1780  102 00
JM094 040 1  4 10  1 1770   92 00
JM094 041 1  4 13  2 1800   79 00
JM094 042 1  1  0  1 1820  121 00
JM094 043 1  7  0  2 1970  102 00
JM094 044 1  7  2  2 1940   48 00
JM094 045 1  2  0  1 2000   85 00
JM094 046 1  7  0  3 2030  120 00
JM094 047 1  1  0  1 2060  128 00
JM094 048 1  2  0  3 2210  150 00
JM094 049 1  7  0  2 2350  188 00
JM094 050 1  7  0  3 2280   99 00
JM094 051 1  1  0  1 2180   53 00
JM094 052 1  2  0  2 3030   55 00
JM094 053 1  7  0  2 3160   67 00
JM094 054 1  4 13  3 3060   96 00
JM094 055 1  7  0  2 2920   69 00
JM094 056 1  7  0  2 2740  134 00
JM094 006 2 050 075 1000 11741 02250 0058 06750 00144 00200 920 2 0800 23031000
JM094     3 671440 421813 00    010500   5 0533333 0038 0016   0 .07 .09 .12   0
JM094     4   0    0    0    0    0 .37 .18 .16   0    0    0    0    0    0    0    0    0
JM095 001 1  1 14 15 1850  173 00  61 000 0000027600 0 1
JM095 002 1  1 14  1 1630  142 00
JM095 003 1  7  2  2 1600  127 00
JM095 004 1  2 14  2 1570  151 00
JM095 005 1  7  2  2 1640  210 00
JM095 006 1  1  0  1 1680  216 00
JM095 007 1  3 14  2 1700  232 00
JM095 008 1  7  2  2 1500  181 00
JM095 009 1  1 14  1 1470  198 00
JM095 010 1  1 14  1 1440  198 00
JM095 011 1  7  0  1 1440  187 00
JM095 012 1  1  0  1 1450  169 00
JM095 013 1  7  0  3 1460  142 00
JM095 014 1  7  2  2 1470  136 00
JM095 015 1  7  1  1 1350  167 00
JM095 016 1  1 14  1 1320  107 00
JM095 017 1  7  0  1 1290  100 00
JM095 018 1  7  0  1 1290   84 00
JM095 019 1  1  0  1 1240   66 00
JM095 020 1  7  0  8 1330   52 00
JM095 021 1  2 14  3 1300   49 00
JM095 022 1  7  2  2 1260   50 00
JM095 023 1  1 13  1 1180   44 00
JM095 024 1  7  0  1 1500   41 00
JM095 025 1  7  0  1 1940   26 00
JM095 026 1  7  0  3 2140   36 00
JM095 027 1  7  0  1  850   14 00
JM095 028 1  4 13  1  860   26 00
JM095 029 1  1 14  3  850   41 00
JM095 030 1  7  0  1  900   65 00
JM095 031 1  2 13  1 1130   62 00
JM095 032 1  3 14  1 1100  107 00
JM095 033 1  4 13  1 1050  171 00
JM095 034 1  7  2  2  300   56 00
```

Table 14.1 - continued

```
JM095 035 1  3 14  1   50   64 00
JM095 036 1  3 14  3   40   66 00
JM095 037 1  1 14  2   50   49 00
JM095 038 1  2 14  1 3370   39 00
JM095 039 1  1 14  1   70  265 00
JM095 040 1  7  1  1   40  272 00
JM095 041 1  7  0  1    0  191 00
JM095 042 1  3 14  3 3540  189 00
JM095 043 1  3 14  1 3490  142 00
JM095 044 1  1  0  1 3220   80 00
JM095 045 1  1  0  2 3220  114 00
JM095 046 1  1 14  1 3120  114 00
JM095 047 1  1 14  1 3120  114 00
JM095 048 1  1 14  1 3120  114 00
JM095 049 1  7  0  3 3100  151 00
JM095 050 1  7  1  1 3080  157 00
JM095 051 1  1 14  1 3030  133 00
JM095 052 1  2 14  2 3100  207 00
JM095 053 1  3  0  2 3140  238 00
JM095 054 1  1 14  1 3260  342 00
JM095 055 1  7  3  1 3300  414 00
JM095 056 1  4 13  2 3380  373 00
JM095 057 1  1 14  3 3250  212 00
JM095 058 1  4  0  3 2950  228 00
JM095 059 1  1  0  3 2680  223 00
JM095 060 1  4 13  1 3090  380 00
JM095 061 1  3 14  1 3210  377 00
JM095 006 2 050 050 0900 11780 03670 0077 12000 00167 00120 925 3 0800 23031000
JM095     3 671380 421836 00    027600   8 0221014 0038 0016 .05 .10 .11   0   0
JM095     4   0 .41   0   0   0 .20 .10   0 .02   0   0 .02   0   0   0   0   0
JM096 001 1  7  0  1 3470    8 00 114 000 0000016650 0 1
JM096 002 1  1  0  1 3440   32 00
JM096 003 1  7  0  1   50  103 00
JM096 004 1  1  0  1 3510  109 00
JM096 005 1  7  0  2 3510  106 00
JM096 006 1  2  0  1 3510   91 00
JM096 007 1  7  0  3 3510   84 00
JM096 008 1  4 10  1 3290   89 00
JM096 009 1  7  0  2 3250   49 00
JM096 010 1  7  3  1 3060   65 00
JM096 011 1  7  0  1 3030   55 00
JM096 012 1  7  0  1 2950   65 00
JM096 013 1  7  0  1 2910   19 00
JM096 014 1  4 10  1 2780   49 00
JM096 015 1  7  0  1 2490  101 00
JM096 016 1  1  0  3 2490  115 00
JM096 017 1  4 13  1 1910   38 00
JM096 018 1  7  0  1 1960   55 00
JM096 019 1  1  0  2 2000  160 00
JM096 020 1  7  3  1 1950  165 00
JM096 021 1  7  0  1 1850  188 00
JM096 022 1  2  0  1 1910  183 00
JM096 023 1  7  3  1 1830   77 00
JM096 024 1  2  0  2 1870   61 00
JM096 025 1  4 10  3 1940   42 00
JM096 026 1  3  0  2 1980   34 00
JM096 027 1  7  0  1 1600   48 00
JM096 028 1  4 10  1 1820  149 00
JM096 029 1  1  0  1 1750  145 00
JM096 030 1  7  0  2 1790  222 00
JM096 031 1  7  0  1 1660  251 00
JM096 032 1  7  0  1 1620  151 00
```

Table 14.1 - continued

JM096	033	1	1	0	1	1530	112	00
JM096	034	1	1	0	1	1500	131	00
JM096	035	1	7	0	1	1500	97	00
JM096	036	1	4	10	1	1450	111	00
JM096	037	1	4	10	1	1400	127	00
JM096	038	1	0	30	2	1400	127	00
JM096	039	1	7	0	1	1410	113	00
JM096	040	1	7	0	1	1410	113	00
JM096	041	1	7	0	1	1310	106	00
JM096	042	1	7	0	1	1290	98	00
JM096	043	1	7	0	3	1290	98	00
JM096	044	1	7	0	1	1250	68	00
JM096	045	1	1	0	1	1180	33	00
JM096	046	1	7	0	1	600	33	00
JM096	047	1	1	0	1	720	58	00
JM096	048	1	2	0	1	750	62	00
JM096	049	1	7	0	1	700	76	00
JM096	050	1	7	1	1	660	99	00
JM096	051	1	4	10	1	880	56	00
JM096	052	1	2	0	2	1200	54	00
JM096	053	1	7	0	2	1180	60	00
JM096	054	1	3	0	2	1050	110	00
JM096	055	1	7	0	1	1090	114	00
JM096	056	1	2	0	2	850	174	00
JM096	057	1	7	1	1	840	173	00
JM096	058	1	7	0	2	870	220	00
JM096	059	1	7	0	1	870	220	00
JM096	060	1	7	1	1	1000	315	00
JM096	061	1	4	10	1	990	282	00
JM096	062	1	7	0	1	1080	261	00
JM096	063	1	2	0	1	1100	250	00
JM096	064	1	2	0	1	1100	229	00
JM096	065	1	7	1	1	1110	225	00
JM096	066	1	4	13	1	1100	204	00
JM096	067	1	2	14	1	1120	184	00
JM096	068	1	3	0	1	1120	177	00
JM096	069	1	3	0	1	1140	171	00
JM096	070	1	7	0	2	1200	212	00
JM096	071	1	3	14	1	1200	212	00
JM096	072	1	7	1	1	1220	220	00
JM096	073	1	3	0	1	1200	246	00
JM096	074	1	2	0	1	1210	246	00
JM096	075	1	2	14	1	1230	263	00
JM096	076	1	2	14	1	1320	242	00
JM096	077	1	2	0	2	1320	230	00
JM096	078	1	2	0	3	1280	231	00
JM096	079	1	2	0	1	1300	220	00
JM096	080	1	7	0	1	1330	208	00
JM096	081	1	2	0	1	1370	229	00
JM096	082	1	7	0	2	1400	241	00
JM096	083	1	7	0	2	1400	208	00
JM096	084	1	7	1	1	1420	202	00
JM096	085	1	2	0	1	1490	209	00
JM096	086	1	2	0	1	1490	202	00
JM096	087	1	2	0	1	1560	258	00
JM096	088	1	7	0	1	1570	259	00
JM096	089	1	7	1	1	1610	272	00
JM096	090	1	1	0	1	1630	265	00
JM096	091	1	2	0	1	1630	263	00
JM096	092	1	1	0	1	1630	228	00
JM096	093	1	7	0	1	1650	250	00
JM096	094	1	7	0	1	1680	242	00

Table 14.1 - continued

JM096	095	1	1	14	1	1690	240	00	
JM096	096	1	2	0	1	1700	253	00	
JM096	097	1	7	0	1	1700	229	00	
JM096	098	1	7	0	1	1730	232	00	
JM096	099	1	7	0	2	1760	240	00	
JM096	100	1	2	0	1	1730	257	00	
JM096	101	1	0	0	0	3210	77	01	
JM096	102	1	0	0	0	3090	64	01	
JM096	103	1	0	0	0	2110	194	01	
JM096	104	1	0	0	0	1200	64	04	
JM096	105	1	0	0	0	1260	83	04	
JM096	106	1	0	0	0	1280	103	04	
JM096	107	1	0	0	0	1230	116	04	
JM096	108	1	0	0	0	1180	126	04	
JM096	109	1	0	0	0	1050	130	04	
JM096	110	1	0	0	0	950	121	04	
JM096	111	1	0	0	0	890	129	04	
JM096	112	1	0	0	0	890	87	04	
JM096	113	1	0	0	0	970	70	04	
JM096	114	1	0	0	0	1100	104	01	
JM096	006	2	225	125	0800	11811	01670	0076	08670 00198 00050 732 3 0800 23031000
JM096		3	671690	421898	03	016650	9	0624624	0038 0014 .06 0 .04 .07 0
JM096		4	0	.04	0	.01	0	.34	.10 .17 .04 0 0 0 0 0 0 0 0
JM097	001	1	7	0	1	1560	33	00	83 000 0000021460 0 1
JM097	002	1	1	0	2	1620	22	00	
JM097	003	1	7	0	3	1750	131	00	
JM097	004	1	3	0	1	1860	170	00	
JM097	005	1	2	0	3	1780	94	00	
JM097	006	1	1	0	1	1820	95	00	
JM097	007	1	4	13	1	1820	79	00	
JM097	008	1	4	13	1	1860	53	00	
JM097	009	1	1	0	0	1940	72	00	
JM097	010	1	4	14	1	1940	72	00	
JM097	011	1	2	14	1	1930	132	00	
JM097	012	1	2	14	1	1980	96	00	
JM097	013	1	1	0	1	1990	127	00	
JM097	014	1	2	14	1	2140	267	00	
JM097	015	1	4	13	1	2000	85	00	
JM097	016	1	1	14	1	2010	56	00	
JM097	017	1	1	14	1	1960	39	00	
JM097	018	1	4	13	1	2100	32	00	
JM097	019	1	2	14	1	2100	59	00	
JM097	020	1	1	14	1	2140	91	00	
JM097	021	1	7	0	1	2190	108	00	
JM097	022	1	1	0	1	2190	108	00	
JM097	023	1	1	0	1	2240	119	00	
JM097	024	1	1	14	1	2260	103	00	
JM097	025	1	7	0	1	2330	87	00	
JM097	026	1	7	0	1	2350	80	00	
JM097	027	1	1	14	1	2280	62	00	
JM097	028	1	7	0	1	2390	17	00	
JM097	029	1	4	13	1	2520	37	00	
JM097	030	1	2	0	1	2540	72	00	
JM097	031	1	1	14	1	2580	80	00	
JM097	032	1	7	0	1	2490	88	00	
JM097	033	1	7	0	1	2460	104	00	
JM097	034	1	7	0	3	2490	109	00	
JM097	035	1	1	14	1	2500	107	00	
JM097	036	1	7	0	3	2790	79	00	
JM097	037	1	1	14	1	2790	86	00	
JM097	038	1	1	14	1	2750	51	00	
JM097	039	1	4	13	1	2760	42	00	

Table 14.1 - continued

```
JM097 040 1  7  1  1 2830   30 00
JM097 041 1  1 14  1 3060   26 00
JM097 042 1  7  0  1 2980   57 00
JM097 043 1  1 14  1 3110   64 00
JM097 044 1  1 14  1 3300   59 00
JM097 045 1  1 14  1 3270  236 00
JM097 046 1  1 14  1 3310  159 00
JM097 047 1  4 13  1 3320  176 00
JM097 048 1  4 13  1 3400  276 00
JM097 049 1  1 14  1 3400  285 00
JM097 050 1  7  0  1 3510  366 00
JM097 051 1  2 14  1 3450  204 00
JM097 052 1  7  0  1 3520  194 00
JM097 053 1  7  0  1 3550  259 00
JM097 054 1  1 14  1  170  336 00
JM097 055 1  1 14  1  150  298 00
JM097 056 1  1 14  1  130  245 00
JM097 057 1  4 13  1  130  246 00
JM097 058 1  7  1  1  110  213 00
JM097 059 1  7  0  1 3550   90 00
JM097 060 1  1 14  1  120   76 00
JM097 061 1  7  0  1 3530   30 00
JM097 062 1  1 14  1 3480   20 00
JM097 063 1  7  0  1  270   56 00
JM097 064 1  1 14  1  300  295 00
JM097 065 1  7  1  1  480  260 00
JM097 066 1  1 14  1  380  215 00
JM097 067 1  1 14  2  500  172 00
JM097 068 1  2 14  3  550  137 00
JM097 069 1  1 14  1  650  160 00
JM097 070 1  7  0  3  800  146 00
JM097 071 1  1 14  1  750   64 00
JM097 072 1  7  0  1  860   72 00
JM097 073 1  7  0  1 1300   96 00
JM097 074 1  1 14  1 1070  112 00
JM097 075 1  7  2 14 1070  119 00
JM097 076 1  1 14  1 1110  143 00
JM097 077 1  1 14  1 1100  160 00
JM097 078 1  7  0  1 1060  159 00
JM097 079 1  1 14  1 1000  158 00
JM097 080 1  3  0  3 1100  181 00
JM097 081 1  1 14  1 1130  225 00
JM087 082 1  7  0  3 1070  217 00
JM097 083 1  2 14  2 1030  221 00
JM097 035 2 035 050 0900 11771 00260 0030 21340 00167 00050 660 3 2500 23031000
JM097     3 671280 421910 00     021460    7 0386766 0038 0013 .04 .01 .11   0   0
JM097     4   0 .46   0   0   0 .27 .07 .02 .02   0   0   0   0   0   0   0   0
JM098 001 1  1  0  1  810   49 00 100 000 0000642180 0 9
JM098 002 1  7  0  1  700   57 00
JM098 003 1  7  0  1  740   86 00
JM098 004 1  3  0  1 1210   68 00
JM098 005 1  2  0  1 1210  105 00
JM098 006 1  3  0  1 1030  159 00
JM098 007 1  7  0  1 1070  168 00
JM098 008 1  7  0  2 1080  169 00
JM098 009 1  3  0  1 1190  147 00
JM098 010 1  3  0  1 1350  115 00
JM098 011 1  3  0  1 1400  125 00
JM098 012 1  3  0  2 1400  129 00
JM098 013 1  3 14  1 1410  123 00
JM098 014 1  2  0  1 1500  139 00
JM098 015 1  4 10  1 1570  127 00
```

Table 14.1 - continued

JM098	016	1	7	1	1	1590	119	00
JM098	017	1	7	0	1	1480	96	00
JM098	018	1	2	0	1	1800	92	00
JM098	019	1	4	10	1	1800	164	00
JM098	020	1	7	0	1	2230	85	00
JM098	021	1	4	13	1	2180	112	00
JM098	022	1	2	0	1	2080	204	00
JM098	023	1	3	0	1	2330	212	00
JM098	024	1	7	0	1	2370	208	00
JM098	025	1	7	0	2	2420	151	00
JM098	026	1	4	13	1	2460	158	00
JM098	027	1	2	0	1	2370	112	00
JM098	028	1	2	0	3	2300	99	00
JM098	029	1	7	1	1	2340	86	00
JM098	030	1	3	0	1	2440	96	00
JM098	031	1	2	0	6	2540	122	00
JM098	032	1	3	0	1	2560	103	00
JM098	033	1	2	0	1	2600	97	00
JM098	034	1	2	0	1	2610	100	00
JM098	035	1	7	0	1	2630	85	00
JM098	036	1	7	0	1	2550	63	00
JM098	037	1	2	0	1	2660	54	00
JM098	038	1	2	0	1	2540	15	00
JM098	039	1	2	14	1	2760	70	00
JM098	040	1	1	0	2	2770	97	00
JM098	041	1	2	0	1	2670	146	00
JM098	042	1	2	0	1	2550	214	00
JM098	043	1	7	0	1	2900	95	00
JM098	044	1	7	0	1	3080	95	00
JM098	045	1	2	0	2	3110	106	00
JM098	046	1	7	0	2	3060	167	00
JM098	047	1	7	0	1	3210	126	00
JM098	048	1	3	0	3	3330	108	00
JM098	049	1	7	0	3	3320	130	00
JM098	050	1	2	14	1	3350	57	00
JM098	051	1	7	0	1	3370	55	00
JM098	052	1	2	0	1	3490	94	00
JM098	053	1	7	0	1	3510	114	00
JM098	054	1	2	0	1	3540	75	00
JM098	055	1	7	0	1	3590	85	00
JM098	056	1	7	0	2	0	75	00
JM098	057	1	7	1	1	20	76	00
JM098	058	1	7	1	1	140	28	00
JM098	059	1	3	0	1	240	59	00
JM098	060	1	1	0	2	1850	27	00
JM098	061	1	2	0	1	1880	49	00
JM098	062	1	1	0	1	1970	88	00
JM098	063	1	1	0	2	2210	222	00
JM098	064	1	7	0	1	1680	66	00
JM098	065	1	7	0	1	1790	92	00
JM098	066	1	7	1	1	1450	188	00
JM098	067	1	2	14	1	1480	47	00
JM098	068	1	7	0	1	1280	53	00
JM098	069	1	3	0	1	1070	45	00
JM098	070	1	3	0	1	1010	42	00
JM098	071	1	3	0	2	1050	147	00
JM098	072	1	3	0	1	720	81	00
JM098	073	1	3	0	1	660	70	00
JM098	074	1	7	0	1	450	68	00
JM098	075	1	2	0	1	590	49	00
JM098	076	1	2	0	1	650	45	00
JM098	077	1	7	0	1	950	20	00

Table 14.1 - continued

```
JM098 078 1  7  1  1 3410   10 00
JM098 079 1  2  0  1  230   55 00
JM098 080 1  2  0  1  140   75 00
JM098 081 1  7  0  1  290  100 00
JM098 082 1  1  0  1  220   94 00
JM098 083 1  7  0  1  140  110 00
JM098 084 1  3  0  1  140   87 00
JM098 085 1  3  0  1  120   85 00
JM098 086 1  3  0  1  100   88 00
JM098 087 1  7  0  1  380  171 00
JM098 088 1  3  0  1  400  173 00
JM098 089 1  1  0  1  400  176 00
JM098 090 1  7  1  1  380  182 00
JM098 091 1  1  0  1  410  198 00
JM098 092 1  1  0  1  290  235 00
JM098 093 1  7  0  1  260  220 00
JM098 094 1  7  0  1  230  220 00
JM098 095 1  2  0  1  260  205 00
JM098 096 1  7  0  1  240  199 00
JM098 097 1  1  0  1  190  188 00
JM098 098 1  1  0  1  260  269 00
JM098 099 1  7  0  3  270  286 00
JM098 100 1  7  0  1  330  282 00
 2230 0810 0000 0000 0000 0000 060 000 000 100 000 000
JM098 006 2 150 150 0500 11826 02670 0076 18260 00213 00000 755 3 0800 23031000
JM098     3 671180 421922 00    642180   7 0015571 0029 0014 .07   0 .02 .02   0
JM098     4   0 .04   0   0   0 .32 .11 .22 .20   0   0   0   0   0   0   0   0
JM099 001 1  7  0  1 1150  110 00 101 000 0000875000 0 9
JM099 002 1  7  0  3 1170   47 00
JM099 003 1  7  3  5 1710   34 00
JM099 004 1  7  0  1 1870   65 00
JM099 005 1  2  0  1 1940  121 00
JM099 006 1  4 13  1 1940  121 00
JM099 007 1  7  0  2 1690  129 00
JM099 008 1  2  0  1 1830  188 00
JM099 009 1  4 13  1 1850  221 00
JM099 010 1  7  1  2 1850  289 00
JM099 011 1  7  3  1 1900  296 00
JM099 012 1  7  1  2 1890  358 00
JM099 013 1  7  0  1 1930  423 00
JM099 014 1  4 13  1 2020  444 00
JM099 015 1  7  1  2 2020  444 00
JM099 016 1  7  0  3 2050  330 00
JM099 017 1  7  0  3 2020  251 00
JM099 018 1  7  0  3 2060  252 00
JM099 019 1  2  0  1 2620  292 00
JM099 020 1  1  0  1 2630  274 00
JM099 021 1  3  0  2 2650  270 00
JM099 022 1  4 13  1 2660  256 00
JM099 023 1  4 13  2 2770  197 00
JM099 024 1  1 15  1 3480   51 00
JM099 025 1  2 13  1 3560  135 00
JM099 026 1  7  0  1    0  151 00
JM099 027 1  7  0  1   20  160 00
JM099 028 1  2  0  1  130  135 00
JM099 029 1  4 13  1  150  128 00
JM099 030 1  4 13  1  260  112 00
JM099 031 1  7  0  1 2620   49 00
JM099 032 1  7  0  1 2280   38 00
JM099 033 1  7  1  3 2270   66 00
JM099 034 1  3  0  3 2320   68 00
JM099 035 1  4 13  1 1900  108 00
```

Table 14.1 - continued

JM099	036	1	7	0	3	1780	78	00
JM099	037	1	2	14	1	1600	152	00
JM099	038	1	2	14	1	1680	151	00
JM099	039	1	4	13	1	1590	148	00
JM099	040	1	7	0	1	1610	138	00
JM099	041	1	2	14	1	1610	139	00
JM099	042	1	2	14	1	1580	125	00
JM099	043	1	3	14	1	1590	115	00
JM099	044	1	7	1	1	1400	131	00
JM099	045	1	2	0	1	1240	118	00
JM099	046	1	4	13	2	1150	141	00
JM099	047	1	7	0	3	1200	77	00
JM099	048	1	7	0	1	1460	93	00
JM099	049	1	7	0	3	1460	87	00
JM099	050	1	7	0	1	1630	50	00
JM099	051	1	4	13	1	1580	35	00
JM099	052	1	7	0	3	850	32	00
JM099	053	1	4	13	1	890	52	00
JM099	054	1	7	1	1	810	96	00
JM099	055	1	4	13	2	800	104	00
JM099	056	1	7	0	1	680	50	00
JM099	057	1	7	0	1	440	70	00
JM099	058	1	7	0	1	380	60	00
JM099	059	1	3	14	1	0	80	00
JM099	060	1	7	0	1	3100	35	00
JM099	061	1	7	0	1	2950	20	00
JM099	062	1	4	13	1	3260	242	00
JM099	063	1	7	2	2	3350	352	00
JM099	064	1	2	0	1	3410	310	00
JM099	065	1	7	0	1	3420	335	00
JM099	066	1	7	0	2	2250	29	00
JM099	067	1	2	0	1	2450	113	00
JM099	068	1	7	1	1	2400	108	00
JM099	069	1	7	0	1	2240	116	00
JM099	070	1	7	0	1	2220	121	00
JM099	071	1	7	3	1	1980	100	00
JM099	072	1	1	0	1	1760	128	00
JM099	073	1	7	0	1	1610	136	00
JM099	074	1	2	0	1	1700	91	00
JM099	075	1	7	1	1	1700	333	00
JM099	076	1	7	1	1	1700	333	00
JM099	077	1	2	14	1	1680	384	00
JM099	078	1	7	0	1	1620	370	00
JM099	079	1	7	0	2	1600	40	00
JM099	080	1	7	0	3	1870	35	00
JM099	081	1	1	0	1	1390	54	00
JM099	082	1	2	0	1	1390	54	00
JM099	083	1	2	0	1	1190	58	00
JM099	084	1	3	0	1	740	37	00
JM099	085	1	7	0	1	540	43	00
JM099	086	1	2	14	1	350	64	00
JM099	087	1	7	0	3	700	16	00
JM099	088	1	7	0	1	400	17	00
JM099	089	1	7	0	1	300	32	00
JM099	090	1	2	0	1	150	60	00
JM099	091	1	4	13	1	120	60	00
JM099	092	1	7	0	1	90	90	00
JM099	093	1	7	0	1	70	90	00
JM099	094	1	1	0	1	70	92	00
JM099	095	1	7	0	1	50	88	00
JM099	096	1	4	13	2	3550	92	00
JM099	097	1	1	0	1	290	197	00

Table 14.1 - continued

```
JM099 098 1  3  0  1   50  215 00
JM099 099 1  1  0  1    0   62 00
JM099 100 1  2  0  1   20   48 00
JM099 101 1  0  0  0 3530  480 01
 1350 1080 1490 1790 0000 0000 031 066 000 065 101 000
JM099 064 2 225 225 2000 11811 05330 0107 13330 00229 00030 810 2 0800 02133030
JM099     3 672580 421846 01     875000   9 0011542 0019 0011 .09 .01 .20   0   0
JM099     4   0 .08 .01   0   0 .39 .06 .12 .04   0   0   0   0   0   0   0   0
JM100 001 1  1 14  1  630  320 00 100 000 0000500000 0 9
JM100 002 1  7  2 14  830  450 00
JM100 003 1  1 14  1  880  490 00
JM100 004 1  7  1  1 1150  411 00
JM100 005 1  7  2 14 1270  342 00
JM100 006 1  2 14  1 1340  242 00
JM100 007 1  1 14  3 1340  242 00
JM100 008 1  7  1  1 1290  220 00
JM100 009 1  3  0  1 1110  262 00
JM100 010 1  3  0  2 1050  205 00
JM100 011 1  7  3  1  910  206 00
JM100 012 1  7  0  1  820  192 00
JM100 013 1  7  0  1  790  267 00
JM100 014 1  7  0  1  750  192 00
JM100 015 1  1 14  1  730  178 00
JM100 016 1  1  0  1  760  173 00
JM100 017 1  7  2 14  790  169 00
JM100 018 1  1 14  2  740  150 00
JM100 019 1  7  1  2  720  136 00
JM100 020 1  1 14  1  700  125 00
JM100 021 1  7  2 14  690  118 00
JM100 022 1  2 14 14  620  120 00
JM100 023 1  1  0  2  640  120 00
JM100 024 1  1 14  2  680   76 00
JM100 025 1  1 14  1  500  214 00
JM100 026 1  1  0  1  480  108 00
JM100 027 1  7  1  1  420  128 00
JM100 028 1  1 14  1  340  125 00
JM100 029 1  7  0  1   50  187 00
JM100 030 1  0 32  1   40  183 00
JM100 031 1  3 14  1 3480  167 00
JM100 032 1  1 14  3 3430  165 00
JM100 033 1  7  0  1 3440  188 00
JM100 034 1  7  2  2 3380  208 00
JM100 035 1  3 14  3 3320  161 00
JM100 036 1  7  1  1 3120  129 00
JM100 037 1  3 14  1 2870   61 00
JM100 038 1  3 14  1 2720   53 00
JM100 039 1  2 14  3 2840   49 00
JM100 040 1  7  1  1 2100   28 00
JM100 041 1  2 14  1 1950   90 00
JM100 042 1  2 14  1 1760  155 00
JM100 043 1  1 14  1 1690  165 00
JM100 044 1  3 14  1 1720  157 00
JM100 045 1  1 14  2 1660  186 00
JM100 046 1  1 14  6 1670  201 00
JM100 047 1  2 14  1 1560  234 00
JM100 048 1  2  0  2 1560  238 00
JM100 049 1  2 14  1 1480  237 00
JM100 050 1  0  0  0   30   95 01
JM100 051 1  4 13  1 2930  368 00
JM100 052 1  7  0  1 3000  373 00
JM100 053 1  7  0  1 2990  358 00
JM100 054 1  4 10  1 2950  344 00
```

Table 14.1 - continued

```
JM100 055 1  1  0  1 2920  342 00
JM100 056 1  4 15  1 2900  340 00
JM100 057 1  7  0  1 2900  340 00
JM100 058 1  4 13  1 2900  340 00
JM100 059 1  7  0  1 2920  329 00
JM100 060 1  7  0  1 2930  267 00
JM100 061 1  1 13  1 2980  119 00
JM100 062 1  7  0  2 3100   91 00
JM100 063 1  7  2  2 3130   80 00
JM100 064 1  1  0  1   70   79 00
JM100 065 1  7  0  3  110   86 00
JM100 066 1  7  1  1  160  121 00
JM100 067 1  4 13  1   80  159 00
JM100 068 1  4 13  1   60  159 00
JM100 069 1  7  0  1 3560  162 00
JM100 070 1  7  0  1   30  147 00
JM100 071 1  7  0  1 2930   66 00
JM100 072 1  7  0  1 2750   33 00
JM100 073 1  7  0  1 2580  107 00
JM100 074 1  7  0  1 2580  173 00
JM100 075 1  7  0  1 2490  115 00
JM100 076 1  4 13  2 2340  116 00
JM100 077 1  2  0  1 2240  137 00
JM100 078 1  7  0  2 2150   43 00
JM100 079 1  7  3  1 1950   44 00
JM100 080 1  7  0  3 1860   61 00
JM100 081 1  7  0  1 1730  247 00
JM100 082 1  4 13  1 1700  247 00
JM100 083 1  7  0  1 1550   60 00
JM100 084 1  7  0  1 1370   48 00
JM100 085 1  4 13  1 1370   48 00
JM100 086 1  1  0  2 1390   81 00
JM100 087 1  7  0  1 1260   78 00
JM100 088 1  7  0  3 1300  215 00
JM100 089 1  7  1  3 1300  187 00
JM100 090 1  7  0  1 1280  186 00
JM100 091 1  7  0  1 1240  188 00
JM100 092 1  4 13  3 1120  195 00
JM100 093 1  7  3  1 1100  184 00
JM100 094 1  4 13  1 1100  193 00
JM100 095 1  4 13  1 1090  183 00
JM100 096 1  7  0  1 1050  150 00
JM100 097 1  2 13  1 1060  141 00
JM100 098 1  4 13  3 1060  136 00
JM100 099 1  7  0  2 1070  107 00
JM100 100 1  2  0  1 1100   95 00
 3240 0600 0000 0000 0000 0000 051 000 000 100 000 000
JM100 064 2 250 250 2300 11646 01330 0033 06000 00064 00120 732 2 0800 02133030
JM100     3 672180 421808 01     050000  11 0200000 0019 0014 .08 .06 .16 .01   0
JM100     4   0 .25 .01   0   0 .30 .06 .03 .02   0   0   0   0   0 .01   0   0
JM103 001 1  2 13  1  650   84 00  13 000 0000002380 0 1
JM103 002 1  7  2  2  730   96 00
JM103 003 1  1 15  2  750  138 00
JM103 004 1  2  0  2  760  145 00
JM103 005 1  3 14  1  820  142 00
JM103 006 1  2  0  2  820  143 00
JM103 007 1  2 13  2  880   90 00
JM103 008 1  2 13  3  900   96 00
JM103 009 1  2  0  2 1060  101 00
JM103 010 1  1 14  2 1020   76 00
JM103 011 1  3  0  1 1050  114 00
JM103 012 1  2 14  2 1520   48 00
```

Table 14.1 - continued

```
JM103 013 1   7   0   2 1860    37 00
JM103 019 2 025 050 3500 11750 07010 0091 11730 00290 00120 704 2 1200 33233020
JM103       3 678990 421317 01      002380    6 0588235 0010 0005    0 .08 .23    0    0
JM103       4    0 .23 .08    0    0 .08    0 .23 .08    0    0    0    0    0    0    0    0
JM104 001 1   7   0   2 2530   129 00   90 000 0010000000 0 9
JM104 002 1   7   1   2 2610   234 00
JM104 003 1   7   0   1 2520   271 00
JM104 004 1   7   1   1 2580   126 00
JM104 005 1   2  15   3 2610    68 00
JM104 006 1   7   1   3 2610    68 00
JM104 007 1   7   0   1 2680   100 00
JM104 008 1   7   3   1 2810    73 00
JM104 009 1   3   0   1 2920    45 00
JM104 010 1   2  14   2 2890    74 00
JM104 011 1   5   0   1 2910    92 00
JM104 012 1   1   0   2 2880   109 00
JM104 013 1   2   0   1 2940   113 00
JM104 014 1   1   0   1 2890   173 00
JM104 015 1   7   0   2 2780   248 00
JM104 016 1   7   0   1 2800   298 00
JM104 017 1   2   0   2 2930   394 00
JM104 018 1   2   0   3   10     8 00
JM104 019 1   0  31  15 3190    54 00
JM104 020 1   1   0   7 3060    48 00
JM104 021 1   4  13   5 2980    56 00
JM104 022 1   0  32   2 2920    49 00
JM104 023 1   3   0   1 2290    43 00
JM104 024 1   3   0   1 2180    47 00
JM104 025 1   0  30  15 2230    90 00
JM104 026 1   0  30  15 2740    28 00
JM104 027 1   0  31   2 2380   156 00
JM104 028 1   0  30  15 2320   168 00
JM104 029 1   0  30  15 2110   150 00
JM104 030 1   7   0   0 1830   133 00
JM104 031 1   3   0   5 1830   145 00
JM104 032 1   3   0   1 1780   142 00
JM104 033 1   2   0   1 1780   150 00
JM104 034 1   1   0   1 1650    83 00
JM104 035 1   4  14   4 1560   140 00
JM104 036 1   7   2   2 1490   132 00
JM104 037 1   1   0   1 1490   176 00
JM104 038 1   3   0   1 1460   175 00
JM104 039 1   3   0   2 1430   180 00
JM104 040 1   3   0   2 1400   175 00
JM104 041 1   3   0   1 1170   142 00
JM104 042 1   3   0   1 1170   142 00
JM104 043 1   3   0   3 1170   142 00
JM104 044 1   3   0   3 1170   142 00
JM104 045 1   3   0   7 1170   142 00
JM104 046 1   3   0   6 1040   179 00
JM104 047 1   3   0   2 1000   178 00
JM104 048 1   3   0   2 1000   178 00
JM104 049 1   3   0   2 1000   178 00
JM104 050 1   0  30  15 1040   133 00
JM104 051 1   1   0   7 1010   137 00
JM104 052 1   3   0   7  980   139 00
JM104 053 1   3   0   2  980   139 00
JM104 054 1   0  31  15  860   127 00
JM104 055 1   3   0   1  840   114 00
JM104 056 1   3   0   1  780   146 00
JM104 057 1   7   0   0  900    62 00
JM104 058 1   0  32  15  910    78 00
```

Table 14.1 - continued

```
JM104 059 1  1  0  3  850   73 00
JM104 060 1  2  0  3  850   73 00
JM104 061 1  2  0  3  850   73 00
JM104 062 1  0 32 15  590   42 00
JM104 063 1  7  2  2 3030   48 00
JM104 064 1  0 31 15 3060   54 00
JM104 065 1  2  0  1 2970   82 00
JM104 066 1  1  0  1 3040   88 00
JM104 067 1  2  0  1 2930   86 00
JM104 068 1  1  0  1 2850   94 00
JM104 069 1  2  0  1 2850   94 00
JM104 070 1  1 14  1 2830   93 00
JM104 071 1  7  0  2 2880  122 00
JM104 072 1  0 32  2 2790  129 00
JM104 073 1  4 15  2 2670  123 00
JM104 074 1  7  0  1 3240   96 00
JM104 075 1  7  2  2 3050  183 00
JM104 076 1  3  0  2 2980  193 00
JM104 077 1  1 14  1 3090  122 00
JM104 078 1  2  0  5 3100  128 00
JM104 079 1  2 14  2 3100  234 00
JM104 080 1  7  0  3 3050  243 00
JM104 081 1  2 16  2 3050  279 00
JM104 082 1  1 15  2 3040  288 00
JM104 083 1  7  2  2 2960  279 00
JM104 084 1  2  0  2 2860  282 00
JM104 085 1  3 15  1 2650  270 00
JM104 086 1  7  0  2 2700  450 00
JM104 087 1  3  0  1 2750  400 00
JM104 088 1  7  0  2 2960  390 00
JM104 089 1  7  1  1 3270  400 00
JM104 090 1  0 32 15 3260  350 00
JM104 053 2 500 050 0000 11781 48260 0016 00914 00260 00360 984 2 0800 01323020
JM104     3 677170 423888 00    999999  14 0001160 0019 0009 .04 .04 .02   0   0
JM104     4   0 .06 .04 .06 .04 .13 .10 .12 .26 .01   0   0   0   0 .06   0   0
JM106 001 1  7  3  7 1220  318 00  16 000 0000008000 0 1
JM106 002 1  0  0 15 1220  318 08
JM106 003 1  0  0  2 1740   47 08
JM106 004 1  7  0 12 1870   28 00
JM106 005 1  0  0  2 2140   30 08
JM106 006 1  0  0  2 1980   43 08
JM106 007 1  0  0 15 2340   56 08
JM106 008 1  7  0  0 2510  120 00
JM106 009 1  0  0 15 2390  118 08
JM106 010 1  0 33  2 2230  105 00
JM106 011 1  0  0 15 2180  113 08
JM106 012 1  7  2  2 2160  112 00
JM106 013 1  0  0 15 2120  110 08
JM106 014 1  6  0  7 2170  124 00
JM106 015 1  6  0  7 2250  132 00
JM106 016 1  0  0 15 2320  142 08
JM106 019 2 015 025 0200 11690 04072 0016 07120 00199 00550 999 1 1200 33233020
JM106     3 677600 421352 00    008000   4 0200000 0019 0011   0 .06 .06   0   0
JM106     4   0   0   0   0   0 .13   0   0   0   0 .13   0   0       0 .06   0
JM108 001 1  0 30 15 2890   68 00 108 000 0000105250 0 9
JM108 002 1  7  0  2 2840   69 00
JM108 003 1  0 31 15 2760  144 00
JM108 004 1  1 14  1 2640  123 00
JM108 005 1  1 16  2 2270  106 00
JM108 006 1  0 30 15 1920  120 00
JM108 007 1  2  0  1 1890  157 00
JM108 008 1  0 30 15 2060  183 00
```

Table 14.1 - continued

JM108	009	1	0	30	15	2050	201	00
JM108	010	1	1	0	1	2050	201	00
JM108	011	1	0	30	15	2010	257	00
JM108	012	1	0	30	15	1940	270	00
JM108	013	1	7	1	2	1870	231	00
JM108	014	1	0	30	15	1820	286	00
JM108	015	1	5	0	3	1830	284	00
JM108	016	1	1	14	1	1870	384	00
JM108	017	1	1	0	3	1870	384	00
JM108	018	1	0	30	15	1890	399	00
JM108	019	1	4	10	2	1950	550	00
JM108	020	1	1	0	2	1960	540	00
JM108	021	1	1	0	2	1970	535	00
JM108	022	1	2	14	2	1940	560	00
JM108	023	1	0	31	15	2240	275	00
JM108	024	1	0	0	15	2280	275	08
JM108	025	1	0	30	15	2270	380	00
JM108	026	1	2	16	3	2330	365	00
JM108	027	1	0	0	15	2350	378	01
JM108	028	1	1	0	3	2340	339	00
JM108	029	1	7	0	2	1440	29	00
JM108	030	1	0	30	15	2680	48	00
JM108	031	1	0	30	15	2900	52	00
JM108	032	1	1	15	1	2370	87	00
JM108	033	1	0	0	15	2370	95	01
JM108	034	1	0	31	15	2090	109	00
JM108	035	1	7	0	0	2660	110	00
JM108	036	1	7	4	2	2650	103	00
JM108	037	1	1	0	2	2670	101	00
JM108	038	1	0	30	15	2700	105	00
JM108	039	1	0	30	15	2840	143	00
JM108	040	1	7	0	1	2840	143	00
JM108	041	1	7	2	2	2800	151	00
JM108	042	1	3	0	2	2810	158	00
JM108	043	1	4	10	1	2820	173	00
JM108	044	1	2	0	3	2810	203	00
JM108	045	1	7	0	1	2820	209	00
JM108	046	1	0	31	15	2850	221	00
JM108	047	1	7	0	2	2900	154	00
JM108	048	1	7	0	2	2900	154	00
JM108	049	1	0	30	15	2400	44	00
JM108	050	1	0	30	15	650	173	00
JM108	051	1	3	14	1	2430	190	00
JM108	052	1	7	2	2	2410	188	00
JM108	053	1	0	0	15	2360	160	08
JM108	054	1	7	1	2	3360	80	00
JM108	055	1	7	0	2	3530	150	00
JM108	056	1	0	0	15	3380	211	08
JM108	057	1	0	30	15	3280	211	00
JM108	058	1	2	0	2	3260	197	00
JM108	059	1	2	0	1	3250	190	00
JM108	060	1	2	16	2	3250	185	00
JM108	061	1	7	1	1	3240	180	00
JM108	062	1	7	0	1	3240	180	00
JM108	063	1	3	0	1	3230	138	00
JM108	064	1	0	30	15	3120	143	00
JM108	065	1	0	30	15	3090	172	00
JM108	066	1	7	0	2	3080	161	00
JM108	067	1	7	0	1	3130	163	00
JM108	068	1	2	17	1	3000	163	00
JM108	069	1	0	30	15	3050	167	00
JM108	070	1	0	30	15	3050	173	00

Table 14.1 - continued

```
JM108 071 1  1  0  1 3070  195 00
JM108 072 1  1  0  1 3070  223 00
JM108 073 1  0 30 15 3120  227 00
JM108 074 1  1  0  0 3160  232 00
JM108 075 1  2  0  1 3190  213 00
JM108 076 1  7  4  2 3190  204 00
JM108 077 1  0 30 15 3440  465 00
JM108 078 1  0 30 15 1570  487 00
JM108 079 1  0 30 15 1700  700 00
JM108 080 1  0 31 15 1770  650 00
JM108 081 1  0 30 15 1810  600 00
JM108 082 1  0  0 15 1800  550 08
JM108 083 1  0 30 15 1800  550 00
JM108 084 1  0 30 15 1800  550 00
JM108 085 1  0 31 15 1800  550 00
JM108 086 1  7  1  1 1800  550 00
JM108 087 1  7  2  2 1490  500 00
JM108 088 1  3  0  3 3510  234 00
JM108 089 1  7  0 11 3510  234 00
JM108 090 1  3  0  7 3510  234 00
JM108 091 1  7  2  2 3510  234 00
JM108 092 1  7  0  2 3510  234 00
JM108 093 1  7  2  2 3510  234 00
JM108 094 1  1  0  2 1640  318 00
JM108 095 1  0 31  2 1680  342 00
JM108 096 1  2 14  1 1730  372 00
JM108 097 1  7  0  2 1900  443 00
JM108 098 1  2  0  1 1870  315 00
JM108 099 1  7  0  2 1520  274 00
JM108 100 1  0 31  2 2020  202 00
JM108 101 1  2 13  2 2110  319 00
JM108 102 1  2  0  2 2120  331 00
JM108 103 1  0 30 15 2260  127 00
JM108 104 1  3 17  3 2350  125 00
JM108 105 1  7  0  2 2300  113 00
JM108 106 1  0 31 15 2300   88 00
JM108 107 1  1  0  2 2300   88 00
JM108 108 1  1  0  2 2300   88 00
JM108 019 2 500 050 1490 11765 48260 0000 91440 00244 00280 954 2 1200 33233020
JM108     3 676600 421361 01    200000  15 0005400 0048 0011 .04 .05 .01 .02   0
JM108     4   0 .05 .01 .26 .08 .15 .11 .06 .04 .01   0   0 .02 .02   0   0   0
JM109 001 1  0  0 15  140  131 08  96 000 0000050000 0 9
JM109 002 1  0 30 15  160  107 00
JM109 003 1  1  0  1  130   98 00
JM109 004 1  0 30 15  200   93 00
JM109 005 1  0 30 15   50   98 00
JM109 006 1  0 30 15  170   68 00
JM109 007 1  4 11  2 1400  122 00
JM109 008 1  0 31 15 1960  124 00
JM109 009 1  0 32 15 1430   73 00
JM109 010 1  0 32 15 1430   72 00
JM109 011 1  0 32 15 1430   77 00
JM109 012 1  0 32 15 1430   77 00
JM109 013 1  0 32 15 1430   80 00
JM109 014 1  0  0 15 1430   80 08
JM109 015 1  0 32 15 1430   90 00
JM109 016 1  0 32 15 1260  174 00
JM109 017 1  1  0  5 1290  272 00
JM109 018 1  7  2  2 1210  261 00
JM109 019 1  2 14  2  940  144 00
JM109 020 1  2  0  2  740  146 00
JM109 021 1  7  1  1  750  173 00
```

Table 14.1 - continued

JM109	022	1	0	32	15	650	113	00
JM109	023	1	7	2	2	620	186	00
JM109	024	1	7	2	2	640	272	00
JM109	025	1	4	14	1	370	246	00
JM109	026	1	1	0	2	340	244	00
JM109	027	1	3	0	3	340	243	00
JM109	028	1	0	31	15	270	315	00
JM109	029	1	0	32	15	280	167	00
JM109	030	1	0	32	15	360	177	00
JM109	031	1	1	14	1	420	162	00
JM109	032	1	2	0	2	390	55	00
JM109	033	1	2	14	3	160	192	00
JM109	034	1	0	33	15	130	151	00
JM109	035	1	7	0	2	210	43	00
JM109	036	1	0	32	15	90	67	00
JM109	037	1	0	32	15	3550	61	00
JM109	038	1	0	32	15	400	48	00
JM109	039	1	0	32	15	400	48	00
JM109	040	1	0	32	15	400	48	00
JM109	041	1	0	32	15	400	48	00
JM109	042	1	0	32	15	400	48	00
JM109	043	1	0	32	15	3210	169	00
JM109	044	1	7	0	2	2850	205	00
JM109	045	1	0	32	15	2730	127	00
JM109	046	1	2	0	2	2610	176	00
JM109	047	1	7	0	2	2640	116	00
JM109	048	1	0	31	0	2660	90	00
JM109	049	1	1	0	2	2800	32	00
JM109	050	1	0	0	15	2320	160	08
JM109	051	1	0	32	15	2280	163	00
JM109	052	1	0	32	15	2250	163	00
JM109	053	1	0	32	15	1980	110	00
JM109	054	1	0	31	15	1980	106	00
JM109	055	1	2	14	2	1940	87	00
JM109	056	1	2	13	2	2500	85	00
JM109	057	1	2	0	2	2520	143	00
JM109	058	1	0	33	15	2830	128	00
JM109	059	1	0	32	15	2950	160	00
JM109	060	1	0	32	15	2970	132	00
JM109	061	1	0	32	15	2960	124	00
JM109	062	1	7	1	2	2950	135	00
JM109	063	1	7	0	2	3000	110	00
JM109	064	1	7	0	15	2950	92	00
JM109	065	1	3	0	11	2960	62	00
JM109	066	1	7	0	0	3000	62	00
JM109	067	1	7	0	2	3370	68	00
JM109	068	1	7	2	7	3500	63	00
JM109	069	1	7	0	2	3550	61	00
JM109	070	1	2	0	1	2810	38	00
JM109	071	1	7	0	2	3400	41	00
JM109	072	1	7	0	2	3470	37	00
JM109	073	1	7	0	2	3510	34	00
JM109	074	1	7	0	15	3560	44	00
JM109	075	1	7	0	15	20	38	00
JM109	076	1	3	14	2	0	33	00
JM109	077	1	7	0	2	3570	75	00
JM109	078	1	7	0	2	100	39	00
JM109	079	1	7	0	2	160	35	00
JM109	080	1	7	0	2	90	47	00
JM109	081	1	7	0	2	80	33	00
JM109	082	1	7	0	2	80	55	00
JM109	083	1	7	0	2	110	52	00

Table 14.1 - continued

```
JM103 084 1  0  0 15  150    48 08
JM109 085 1  7  0  2  160    49 00
JM109 086 1  7  0  2  200    52 00
JM109 087 1  7  0  2  200    54 00
JM109 038 1  7  2  2  290    51 00
JM109 089 1  0 32 15  390    54 00
JM109 090 1  1  0  2  460    63 00
JM109 091 1  1  0  1  470    54 00
JM109 092 1  7  0  2  500    55 00
JM109 093 1  7  0  2  710    62 00
JM109 094 1  7  1  2  810    36 00
JM109 095 1  7  0  2  800    28 00
JM109 096 1  7  0  2 1660    39 00
 3580 0800 2940 0872 0000 0000 009 056 000 055 096 000
JM109 019 2 015 050 3200 11750 16090 0000 04570 00290 00430 989 2 1200 33233020
JM109     3 676900 421357 00    050000  12 0192000 0038 0009 .03 .05 .01   0 .01
JM109     4   0 .06   0 .04 .04 .28 .06 .05 .02   0   0   0   0   0 .27 .02   0
JM110 001 1  7  4  1  370    65 00 114 000 0000500000 0 1
JM110 002 1  0 31 15  410    62 00
JM110 003 1  0 30 15  380    84 00
JM110 004 1  1  0  1  380    84 00
JM110 005 1  1  0  1  330    63 00
JM110 006 1  2 14  5  330    63 00
JM110 007 1  3  0  1  330    63 00
JM110 008 1  0 30 15  420   114 00
JM110 009 1  0 30 15  420   112 00
JM110 010 1  0 31 15  690    21 00
JM110 011 1  2  0  2  610   108 00
JM110 012 1  2  0  1  600   108 00
JM110 013 1  0 31 15  360   153 00
JM110 014 1  0 30 15  310   180 00
JM110 015 1  0 30 15  310   141 00
JM110 016 1  2 14  3  290   139 00
JM110 017 1  0 30 15  290   139 00
JM110 018 1  1 14  2  280    98 00
JM110 019 1  0 31  2  290    94 00
JM110 020 1  0 31 15  270    94 00
JM110 021 1  3  0  1  200    57 00
JM110 022 1  0 31 15  240    90 00
JM110 023 1  0 30 15  240    90 00
JM110 024 1  0 31  2  200   102 00
JM110 025 1  0 30 15  240   105 00
JM110 026 1  1  0  2  190   118 00
JM110 027 1  7  0  3  210   135 00
JM110 028 1  4 17  3  200   146 00
JM110 029 1  3  0  1  240   167 00
JM110 030 1  0 30 15  240   167 00
JM110 031 1  0 30 15  240   167 00
JM110 032 1  0 30 15  250   170 00
JM110 033 1  1  0  1  280   207 00
JM110 034 1  2  0  1  280   207 00
JM110 035 1  2 13  1  280   207 00
JM110 036 1  2  0  1  210   233 00
JM110 037 1  3  0  1  130    51 00
JM110 038 1  0 30 15  190    80 00
JM110 039 1  0 30 15  190   104 00
JM110 040 1  0 30 15  190   104 00
JM110 041 1  0 30 15  140   105 00
JM110 042 1  5  0  3  130    99 00
JM110 043 1  0 30 15  180   114 00
JM110 044 1  7  0  3  180   114 00
JM110 045 1  2  0  1  150   125 00
```

Table 14.1 - continued

JM110	046	1	3	13	1	150	128	00
JM110	047	1	3	0	2	150	128	00
JM110	048	1	2	0	3	150	128	00
JM110	049	1	7	2	2	160	133	00
JM110	050	1	7	4	1	130	147	00
JM110	051	1	2	0	2	130	147	00
JM110	052	1	4	0	11	130	147	00
JM110	053	1	0	30	15	170	154	00
JM110	054	1	4	0	11	160	164	00
JM110	055	1	2	0	3	160	164	00
JM110	056	1	2	0	3	160	164	00
JM110	057	1	2	13	6	160	164	00
JM110	058	1	3	0	3	190	172	00
JM110	059	1	1	13	1	170	185	00
JM110	060	1	3	0	3	160	180	00
JM110	061	1	2	13	3	160	180	00
JM110	062	1	3	0	1	180	193	00
JM110	063	1	3	0	1	180	193	00
JM110	064	1	3	0	3	180	193	00
JM110	065	1	3	14	1	170	192	00
JM110	066	1	0	30	15	150	192	00
JM110	067	1	2	0	2	180	203	00
JM110	068	1	2	13	2	170	201	00
JM110	069	1	1	13	3	170	201	00
JM110	070	1	0	0	2	170	214	08
JM110	071	1	0	30	15	200	242	00
JM110	072	1	7	0	1	180	236	00
JM110	073	1	7	2	2	180	245	00
JM110	074	1	3	14	1	90	114	00
JM110	075	1	1	0	1	90	114	00
JM110	076	1	2	14	3	40	107	00
JM110	077	1	2	13	2	70	77	00
JM110	078	1	0	30	15	80	276	00
JM110	079	1	0	30	15	70	282	00
JM110	080	1	0	30	15	50	290	00
JM110	081	1	7	1	1	50	290	00
JM110	082	1	7	4	3	80	330	00
JM110	083	1	2	0	11	60	239	00
JM110	084	1	7	2	2	60	239	00
JM110	085	1	0	30	15	50	331	00
JM110	086	1	0	31	15	50	331	00
JM110	087	1	2	0	8	50	339	00
JM110	088	1	0	30	15	50	344	00
JM110	089	1	4	10	2	50	342	00
JM110	090	1	3	0	3	3590	322	00
JM110	091	1	7	4	1	3590	322	00
JM110	092	1	1	13	1	3590	322	00
JM110	093	1	2	0	3	3590	312	00
JM110	094	1	3	0	3	3580	274	00
JM110	095	1	3	0	6	3590	312	00
JM110	096	1	7	1	2	3590	277	00
JM110	097	1	3	13	1	3590	277	00
JM110	098	1	7	2	2	40	237	00
JM110	099	1	7	2	2	40	237	00
JM110	100	1	2	15	1	3570	173	00
JM110	101	1	7	0	2	10	149	00
JM110	102	1	2	0	1	0	140	00
JM110	103	1	2	13	1	3590	144	00
JM110	104	1	2	0	2	3590	137	00
JM110	105	1	2	13	1	3590	137	00
JM110	106	1	3	0	3	3570	132	00
JM110	107	1	3	0	3	3570	132	00

Table 14.1 - continued

```
JM110 108 1   2 14   1    40   136 00
JM110 109 1   0 31  15 3580    116 00
JM110 110 1   3  0   1    30    90 00
JM110 111 1   7  0   2 3590     82 00
JM110 112 1   0 31  15 3540     90 00
JM110 113 1   0 30  15 3460     54 00
JM110 114 1   2 10   2 3410     56 00
JM110 019 2 020 050 0000 11660 32190 0015 08050 00137 04400 989 2 1200 33233020
JM110     3 676315 421359 00     500000   15 0022800 0048 0011  .02  .04  .11  .02    0
JM110     4    0  .06  .01  .22  .09  .04  .04  .13  .14  .01    0  .02  .04  .01    0    0    0
JM112 001 1   0 30  15 1490    245 00  31 000 0000094000 0 1
JM112 002 1   0 30  15 1610    312 00
JM112 003 1   0 30  15 1590    395 00
JM112 004 1   0 30  15 1440    800 00
JM112 005 1   0 30  15 1370    700 00
JM112 006 1   7  0   3 1360    680 00
JM112 007 1   0  0   0 1750    290 01
JM112 008 1   0 30  15 1770    317 00
JM112 009 1   0 30  15 1610    317 00
JM112 010 1   0 32  15 2050    188 00
JM112 011 1   0 30  15 2080    308 00
JM112 012 1   0 30  15 2110    295 00
JM112 013 1   0 30  15 2090    100 00
JM112 014 1   0 30  15 2000     64 00
JM112 015 1   7  4   1 2240     67 00
JM112 016 1   0 30  15 2310    112 00
JM112 017 1   0 30  15 2260    163 00
JM112 018 1   0 30  15 2340    262 00
JM112 019 1   0 31  15 2310    350 00
JM112 020 1   0 30  15 2420    323 00
JM112 021 1   0 30  15 2420    328 00
JM112 022 1   0 30  15 2450    350 00
JM112 023 1   0 30  15 2460    348 00
JM112 024 1   0 30  15 2460    323 00
JM112 025 1   0 30  15 2480    316 00
JM112 026 1   0 30  15 2800     30 00
JM112 027 1   0 30  15 3120     34 00
JM112 028 1   0 30  15 3110    147 00
JM112 029 1   0 31  15 3310    177 00
JM112 030 1   0 30  15 3410     44 00
JM112 031 1   0 30  15  600     32 00
JM112 019 2 020 040 0450 11660 01520 0030 07010 00137 05200 999 1 1200 33233020
JM112     3 676140 421355 01     094000    4 0032978 0048 0011    0    0    0    0    0
JM112     4    0    0    0  .81  .06  .03    0    0    0    0    0    0  .03    0  .03    0    0
JM113 001 1   7  4   2 1650    302 00  60 000 0000076000 0 1
JM113 002 1   3  0   1 1680    378 00
JM113 003 1   0 30  15 1690    450 00
JM113 004 1   2  0   1 1730    303 00
JM113 005 1   7  1   1 1750    300 00
JM113 006 1   0 30  15 1750    290 00
JM113 007 1   2  0   1 1760    285 00
JM113 008 1   0 30  15 1790    249 00
JM113 009 1   2  0   1 1820    216 00
JM113 010 1   2  0   1 1840    209 00
JM113 011 1   1  0   1 1850    194 00
JM113 012 1   0 31   2 1790    105 00
JM113 013 1   0 30  15 1980     79 00
JM113 014 1   0 31   2 2070     97 00
JM113 015 1   7  1   1 2130     65 00
JM113 016 1   7  2   1 2250     40 00
JM113 017 1   7  2   2 2040     32 00
JM113 018 1   7  0   1 2090     40 00
```

Table 14.1 - continued

```
JM113 019 1  0 31 15 2430   59 00
JM113 020 1  0 30 15 2270  126 00
JM113 021 1  3  0  1 2300  210 00
JM113 022 1  0 31 15 3000   26 00
JM113 023 1  0 30 15 2840   43 00
JM113 024 1  0 30 15 2950  445 00
JM113 025 1  0 30 15 3000  466 00
JM113 026 1  7  1  2 3000  410 00
JM113 027 1  7  1  1 2220  109 00
JM113 028 1  0 31 15 3500  385 00
JM113 029 1  7  1  1 3500  385 00
JM113 030 1  2  0  3 3570  475 00
JM113 031 1  0 30 15   40  230 00
JM113 032 1  7  2  1  100  326 00
JM113 033 1  7  2  1  170  231 00
JM113 034 1  0 31 15  210  150 00
JM113 035 1  0 30 15  400  100 00
JM113 036 1  0 30 15  410  170 00
JM113 037 1  0 30 15  380  247 00
JM113 038 1  2  0  1  360  261 00
JM113 039 1  7  2  2  310  422 00
JM113 040 1  2  0  2  550  225 00
JM113 041 1  0 31 15  660  225 00
JM113 042 1  0 30 15  700  186 00
JM113 043 1  0 30 15  660   80 00
JM113 044 1  7  2  1  690  250 00
JM113 045 1  0 31  2  750  220 00
JM113 046 1  5  0  3  770  220 00
JM113 047 1  0 31 15  850  237 00
JM113 048 1  0 31 15  850  242 00
JM113 049 1  0 31 15  830  125 00
JM113 050 1  0 30 15  960  200 00
JM113 051 1  1  0  1  960  210 00
JM113 052 1  7  1  1  960  755 00
JM113 053 1  7  2  2  920  350 00
JM113 054 1  0 30 15 1050  350 00
JM113 055 1  0 30 15 1090  320 00
JM113 056 1  0 30 15 1100  250 00
JM113 057 1  0 30 15 1200  250 00
JM113 058 1  7  1  1  930  375 00
JM113 059 1  2  0  1 1070  375 00
JM113 060 1  0 30 15 1070  390 00
JM113 019 2 040 075 0470 11630 01680 0061 06100 00107 06000 999 1 1200 33233020
JM113     3 675980 421380 00     076000    9 0078947 0038 0011 .12 .12   0   0   0
JM113     4   0   0   0 .33 .18 .02 .03 .13 .03 .02   0   0 .02   0   0   0   0
JM114 001 1  0 30 15  370   16 00 101 000 0000060000 0 1
JM114 002 1  7  0  2  460   21 00
JM114 003 1  0 30 15  570   27 00
JM114 004 1  7  1  1  570   28 00
JM114 005 1  0 30 15  580   36 00
JM114 006 1  2  0  1  830   53 00
JM114 007 1  0 30 15  710   73 00
JM114 008 1  7  4  1  710   73 00
JM114 009 1  0 30 15  740   84 00
JM114 010 1  0 30 15  860  108 00
JM114 011 1  2  0  1  810  118 00
JM114 012 1  2  0  3  730  105 00
JM114 013 1  3  0  3  730  105 00
JM114 014 1  2  0  1  610   72 00
JM114 015 1  0 30 15  600   76 00
JM114 016 1  0 30 15  620   79 00
JM114 017 1  0 30 15  530   80 00
```

Table 14.1 - continued

JM114	018	1	3	0	3	530	80	00
JM114	019	1	3	0	3	530	80	00
JM114	020	1	0	31	15	580	47	00
JM114	021	1	7	0	1	490	47	00
JM114	022	1	0	31	15	400	61	00
JM114	023	1	3	0	1	350	85	00
JM114	024	1	3	0	4	350	85	00
JM114	025	1	0	30	15	330	110	00
JM114	026	1	0	31	15	430	112	00
JM114	027	1	7	0	3	410	113	00
JM114	028	1	7	0	2	450	118	00
JM114	029	1	0	31	15	390	125	00
JM114	030	1	0	30	15	410	143	00
JM114	031	1	2	0	1	390	145	00
JM114	032	1	7	0	2	500	180	00
JM114	033	1	7	0	3	270	169	00
JM114	034	1	2	0	1	280	168	00
JM114	035	1	0	30	15	280	168	00
JM114	036	1	7	2	2	290	175	00
JM114	037	1	7	2	2	260	162	00
JM114	038	1	7	2	2	260	163	00
JM114	039	1	2	0	1	230	160	00
JM114	040	1	2	0	3	250	102	00
JM114	041	1	7	0	3	220	104	00
JM114	042	1	2	0	1	180	105	00
JM114	043	1	7	0	3	180	106	00
JM114	044	1	3	0	2	170	98	00
JM114	045	1	2	0	1	180	99	00
JM114	046	1	2	0	3	150	124	00
JM114	047	1	7	0	3	150	124	00
JM114	048	1	7	0	1	150	124	00
JM114	049	1	7	0	1	160	130	00
JM114	050	1	2	0	1	160	130	00
JM114	051	1	7	0	1	160	134	00
JM114	052	1	7	1	1	160	70	00
JM114	053	1	4	10	7	100	64	00
JM114	054	1	7	2	1	50	50	00
JM114	055	1	0	30	15	0	45	00
JM114	056	1	2	0	1	10	45	00
JM114	057	1	7	0	1	70	40	00
JM114	058	1	7	0	1	3460	40	00
JM114	059	1	3	0	1	3480	38	00
JM114	060	1	2	0	3	130	35	00
JM114	061	1	2	0	1	210	28	00
JM114	062	1	0	30	15	250	29	00
JM114	063	1	7	0	3	400	36	00
JM114	064	1	2	0	1	400	39	00
JM114	065	1	3	0	1	470	35	00
JM114	066	1	7	2	1	690	174	00
JM114	067	1	7	0	1	690	178	00
JM114	068	1	7	2	1	720	162	00
JM114	069	1	0	30	15	850	133	00
JM114	070	1	7	0	3	860	181	00
JM114	071	1	2	15	1	860	190	00
JM114	072	1	0	30	15	1010	150	00
JM114	073	1	0	30	15	1010	150	00
JM114	074	1	0	30	15	1010	150	00
JM114	075	1	3	0	1	1020	151	00
JM114	076	1	3	0	3	1040	153	00
JM114	077	1	2	0	1	1040	155	00
JM114	078	1	1	0	1	1070	158	00
JM114	079	1	7	0	1	1150	155	00

Table 14.1 - continued

```
JM114 080 1  3  0  1 1170  168 00
JM114 081 1  2  0  3 1210  113 00
JM114 082 1  2  0  1 1230   95 00
JM114 083 1  2  0  1 1260   96 00
JM114 084 1  7  0  1 1320  105 00
JM114 085 1  0 30 15 1270  255 00
JM114 086 1  3  0  3 1270  255 00
JM114 087 1  2  0  1 1380  147 00
JM114 088 1  3  0  1 1400  136 00
JM114 089 1  7  0  2 1390  125 00
JM114 090 1  0 30 15 1410   87 00
JM114 091 1  0 31 15 1100  157 00
JM114 092 1  1  0  1 1810   31 00
JM114 093 1  7  0  2 1750   42 00
JM114 094 1  0 30 15 1560   45 00
JM114 095 1  0 30 15 1510   48 00
JM114 096 1  0 30 15 1620   76 00
JM114 097 1  0 31 15 1620   76 00
JM114 098 1  7  2  2 1620   76 00
JM114 099 1  3  0  1 1690   67 00
JM114 100 1  2  0  1 1700   69 00
JM114 101 1  0 30  0 2290  800 00
JM114 053 2 040 075 0580 11765 01500 0000 06000 00244 04400 968 3 0800 01323020
JM114     3 675140 421377 00     060000  10 0168333 0019 0009 .02 .07   0 .01   0
JM114     4   0    0 .01 .24 .06 .21 .02 .22 .14   0   0   0 .01   0   0   0   0
JM115 001 1  7  1  1 2610   22 00 100 000 000040000 0 1
JM115 002 1  7  0  2 2440   28 00
JM115 003 1  7  0  1 2450   28 00
JM115 004 1  7  0  2 2520   28 00
JM115 005 1  2 14  1 2510   31 00
JM115 006 1  7  2  2 2500   29 00
JM115 007 1  2 14  2 2430   37 00
JM115 008 1  2 14  2 2430   37 00
JM115 009 1  7  2  2 2270   34 00
JM115 010 1  2 14  2 2250   25 00
JM115 011 1  7  0  3 1760   33 00
JM115 012 1  2  0  2 1760   33 00
JM115 013 1  1 14  1 1750   27 00
JM115 014 1  2 14  2 1750   27 00
JM115 015 1  2  0  2 1750   27 00
JM115 016 1  7  0  2 1650   30 00
JM115 017 1  1  0  2 1630   36 00
JM115 018 1  7  0  2 1520   61 00
JM115 019 1  7  4  2 1760   88 00
JM115 020 1  7  4  2 1770   87 00
JM115 021 1  1  0  2 1730   87 00
JM115 022 1  2 14  2 1680   88 00
JM115 023 1  7  0  2 1610   92 00
JM115 024 1  1 14  2 1730  109 00
JM115 025 1  7  2  2 1720  109 00
JM115 026 1  7  4  2 1750  106 00
JM115 027 1  2  0  2 1730  103 00
JM115 028 1  3 15  2 1730  103 00
JM115 029 1  2 14  2 1770  111 00
JM115 030 1  7  2  3 1810  114 00
JM115 031 1  2  0  2 1810  114 00
JM115 032 1  7  2  2 1810  114 00
JM115 033 1  2 14  2 1810  114 00
JM115 034 1  2  0  2 1810  114 00
JM115 035 1  3 15  2 1810  110 00
JM115 036 1  7  0  3 1820  107 00
JM115 037 1  2  0  2 1810  107 00
```

Table 14.1 - continued

JM115	038	1	2	13	1	1830	98	00
JM115	039	1	2	14	2	1830	98	00
JM115	040	1	7	1	2	1830	96	00
JM115	041	1	2	0	2	1830	96	00
JM115	042	1	1	0	2	1860	96	00
JM115	043	1	3	13	1	1860	96	00
JM115	044	1	0	30	15	1910	99	00
JM115	045	1	7	0	2	1890	68	00
JM115	046	1	7	4	3	1910	70	00
JM115	047	1	7	2	2	1920	69	00
JM115	048	1	2	0	2	1930	90	00
JM115	049	1	2	0	1	1930	90	00
JM115	050	1	7	2	2	1940	86	00
JM115	051	1	0	30	15	1880	115	00
JM115	052	1	0	30	15	1880	115	00
JM115	053	1	1	13	1	1880	115	00
JM115	054	1	7	2	2	1900	116	00
JM115	055	1	3	15	2	1900	116	00
JM115	056	1	1	0	2	1890	124	00
JM115	057	1	1	13	2	1900	123	00
JM115	058	1	1	13	2	1840	142	00
JM115	059	1	1	14	7	1840	142	00
JM115	060	1	0	30	15	1850	138	00
JM115	061	1	2	0	7	1850	138	00
JM115	062	1	1	14	1	1850	138	00
JM115	063	1	2	13	2	1880	139	00
JM115	064	1	7	2	2	1860	154	00
JM115	065	1	7	3	2	1840	151	00
JM115	066	1	2	0	3	1840	151	00
JM115	067	1	1	14	3	1840	151	00
JM115	068	1	2	14	2	1840	151	00
JM115	069	1	0	30	2	1840	172	00
JM115	070	1	1	13	3	1840	172	00
JM115	071	1	7	3	1	1840	172	00
JM115	072	1	4	0	2	1840	172	00
JM115	073	1	7	3	2	1850	176	00
JM115	074	1	7	2	2	1840	182	00
JM115	075	1	7	0	1	1820	190	00
JM115	076	1	7	1	2	1810	192	00
JM115	077	1	2	15	2	1510	90	00
JM115	078	1	1	0	2	1510	90	00
JM115	079	1	7	2	2	1480	79	00
JM115	080	1	2	0	1	1540	59	00
JM115	081	1	3	0	1	1540	59	00
JM115	082	1	2	13	2	1400	61	00
JM115	083	1	2	13	3	1390	33	00
JM115	084	1	1	0	1	950	25	00
JM115	085	1	2	0	1	950	25	00
JM115	086	1	1	14	7	980	62	00
JM115	087	1	7	2	1	930	60	00
JM115	088	1	1	13	2	1000	81	00
JM115	089	1	1	13	1	990	82	00
JM115	090	1	1	0	2	990	82	00
JM115	091	1	3	0	1	870	55	00
JM115	092	1	0	31	15	880	53	00
JM115	093	1	7	0	3	750	67	00
JM115	094	1	7	1	2	750	67	00
JM115	095	1	7	2	2	550	25	00
JM115	096	1	7	0	3	550	25	00
JM115	097	1	4	10	2	500	29	00
JM115	098	1	7	2	2	470	23	00
JM115	099	1	1	13	2	3270	68	00

Table 14.1 - continued

```
JM115 100 1   1 15   1 3470    66 00
JM115 053 2 100 100 0500 11841 01100 0061 04000 00305 06800 999 1 0800 01323020
JM115     3 675290 421400 00     400000  14 0025000 0019 0009 .04 .14 .15 .01    0
JM115     4    0 .15 .05 .05 .01 .12 .07 .13 .02   0    0 .01 .04   0    0    0    0
JM116 001 1   1  0   1 2490    21 00 100 000 0001250000 0 1
JM116 002 1   4 10   1 2470    88 00
JM116 003 1   7  2   2 2450   121 00
JM116 004 1   7  0   1 2320   132 00
JM116 005 1   7  1   1 2210   143 00
JM116 006 1   7  1   1 2160   147 00
JM116 007 1   1  0   1 2180   145 00
JM116 008 1   7  0   1 2060   102 00
JM116 009 1   7  0   3 2040    99 00
JM116 010 1   1  0   2 1980   107 00
JM116 011 1   2 14   3 1970    75 00
JM116 012 1   3 14   3 1940   109 00
JM116 013 1   3  0   3 1950   144 00
JM116 014 1   3  0   1 1950   144 00
JM116 015 1   4 10   1 1950   152 00
JM116 016 1   7  0   1 1940   149 00
JM116 017 1   7  2   1 1930   153 00
JM116 018 1   7  0   1 1890   150 00
JM116 019 1   4 15   1 1870   151 00
JM116 020 1   7  0   2 1760   188 00
JM116 021 1   4 10   1 1750   192 00
JM116 022 1   4 13   1 1740   189 00
JM116 023 1   7  0   1 1720   141 00
JM116 024 1   7  0   1 1600    93 00
JM116 025 1   1  0   3 1610   106 00
JM116 026 1   2  0   2 1330    95 00
JM116 027 1   3  0   2 1270    91 00
JM116 028 1   7  0   1 1300    90 00
JM116 029 1   7  0   1 1310    87 00
JM116 030 1   2 14   1 1240    47 00
JM116 031 1   4 10   2 1110    30 00
JM116 032 1   7  0   2 1040    31 00
JM116 033 1   7  0   2 1090    47 00
JM116 034 1   2 14   1  990    54 00
JM116 035 1   2 14   1  980    56 00
JM116 036 1   7  0   1  730    38 00
JM116 037 1   7  0   1  520    65 00
JM116 038 1   2 14   3  370    29 00
JM116 039 1   7  2   2  350    41 00
JM116 040 1   7  0   1  380    94 00
JM116 041 1   2  0   1  440    94 00
JM116 042 1   7  0   3  370   123 00
JM116 043 1   7  0   1  370   178 00
JM116 044 1   7  0   1  330    70 00
JM116 045 1   7  0   6  320    69 00
JM116 046 1   7  0   3  300    67 00
JM116 047 1   0 31  15  270   530 00
JM116 048 1   7  0   2  280   540 00
JM116 049 1   0 31   1  280   540 00
JM116 050 1   7  1   2  260   343 00
JM116 051 1   7  0   2  250   290 00
JM116 052 1   3  0   1  250   290 00
JM116 053 1   7  0   1  260   188 00
JM116 054 1   3  0   1  260   177 00
JM116 055 1   2  0   2  260   177 00
JM116 056 1   3  0   1  260   155 00
JM116 057 1   2  0   3  240   151 00
JM116 058 1   2  0   2  230   148 00
```

Table 14.1 - continued

JM116	059	1	2	0	3	230	182	00											
JM116	060	1	2	0	3	240	187	00											
JM116	061	1	3	0	3	240	189	00											
JM116	062	1	7	0	2	240	315	00											
JM116	063	1	4	10	2	220	265	00											
JM116	064	1	0	31	15	210	268	00											
JM116	065	1	7	0	1	200	312	00											
JM116	066	1	4	15	1	160	303	00											
JM116	067	1	7	0	1	160	303	00											
JM116	068	1	7	0	2	150	303	00											
JM116	069	1	4	10	2	110	361	00											
JM116	070	1	7	1	2	70	399	00											
JM116	071	1	7	0	1	160	269	00											
JM116	072	1	7	0	1	120	789	00											
JM116	073	1	7	0	2	100	260	00											
JM116	074	1	7	0	1	60	286	00											
JM116	075	1	7	0	1	60	244	00											
JM116	076	1	7	0	3	3570	221	00											
JM116	077	1	3	0	1	3460	273	00											
JM116	078	1	7	0	1	3450	259	00											
JM116	079	1	7	0	1	3520	190	00											
JM116	080	1	7	2	1	3520	192	00											
JM116	081	1	4	13	1	3540	168	00											
JM116	082	1	2	0	1	3490	122	00											
JM116	083	1	4	13	1	3540	58	00											
JM116	084	1	3	0	3	180	47	00											
JM116	085	1	7	0	3	160	78	00											
JM116	086	1	4	13	1	180	100	00											
JM116	087	1	7	0	3	160	127	00											
JM116	088	1	7	0	2	160	142	00											
JM116	089	1	2	0	3	150	151	00											
JM116	090	1	2	0	1	120	124	00											
JM116	091	1	2	0	1	100	125	00											
JM116	092	1	7	0	1	3320	100	00											
JM116	093	1	7	0	1	3150	138	00											
JM116	094	1	2	0	1	3090	135	00											
JM116	095	1	7	0	1	3050	258	00											
JM116	096	1	7	0	1	3050	262	00											
JM116	097	1	7	0	2	3030	229	00											
JM116	098	1	7	0	1	3050	238	00											
JM116	099	1	7	0	1	3100	239	00											
JM116	100	1	2	0	2	3110	248	00											
JM116	053	2	150	150	3000	11860	03500	0198	02500	00320	05200	999	1	0800	01323020				
JM116		3	674538	421431	00	125000	10	0008000	0010	0005	.04	.04	.04	.06	0				
JM116		4	0	.06	.02	0	.03	.45	.04	.13	.09	0	0	0	0	0	0	0	0
JM117	001	1	3	0	3	2640	252	00	101	000	0000300000	0	9						
JM117	002	1	5	0	6	2590	234	00											
JM117	003	1	7	0	3	2520	200	00											
JM117	004	1	1	0	3	2520	200	00											
JM117	005	1	4	11	3	2510	174	00											
JM117	006	1	3	0	2	2500	178	00											
JM117	007	1	3	0	3	2500	178	00											
JM117	008	1	5	0	3	2500	170	00											
JM117	009	1	1	0	1	2470	175	00											
JM117	010	1	1	0	6	2460	178	00											
JM117	011	1	2	0	3	2450	174	00											
JM117	012	1	3	0	2	2430	176	00											
JM117	013	1	7	0	3	2500	171	00											
JM117	014	1	5	0	3	2500	171	00											
JM117	015	1	5	0	2	2530	125	00											
JM117	016	1	4	11	3	2570	115	00											
JM117	017	1	1	0	2	2570	115	00											

Table 14.1 - continued

JM117	018	1	5	0	2	2570	115	00
JM117	019	1	1	0	2	2100	102	00
JM117	020	1	0	31	15	2070	103	00
JM117	021	1	7	0	2	2130	59	00
JM117	022	1	0	30	15	2230	38	00
JM117	023	1	2	0	2	2240	38	00
JM117	024	1	5	0	2	2310	30	00
JM117	025	1	5	0	2	2310	30	00
JM117	026	1	3	0	2	2500	32	00
JM117	027	1	2	0	1	2950	62	00
JM117	028	1	1	0	2	2950	62	00
JM117	029	1	3	0	2	2950	62	00
JM117	030	1	2	0	2	3040	106	00
JM117	031	1	7	0	3	3050	110	00
JM117	032	1	3	0	2	3120	98	00
JM117	033	1	7	0	1	3250	117	00
JM117	034	1	2	0	3	3430	156	00
JM117	035	1	2	0	1	3440	163	00
JM117	036	1	2	0	2	3480	81	00
JM117	037	1	3	0	6	3480	43	00
JM117	038	1	5	0	2	3480	43	00
JM117	039	1	2	0	5	140	49	00
JM117	040	1	1	0	2	340	52	00
JM117	041	1	2	0	1	380	60	00
JM117	042	1	5	0	2	400	62	00
JM117	043	1	3	0	1	550	65	00
JM117	044	1	7	0	2	720	52	00
JM117	045	1	2	0	2	1000	94	00
JM117	046	1	2	0	2	930	95	00
JM117	047	1	2	0	1	620	89	00
JM117	048	1	1	0	2	580	95	00
JM117	049	1	1	0	1	270	75	00
JM117	050	1	7	0	2	230	71	00
JM117	051	1	1	0	1	230	71	00
JM117	052	1	5	0	2	160	66	00
JM117	053	1	5	0	2	210	79	00
JM117	054	1	1	0	2	110	76	00
JM117	055	1	1	0	3	110	76	00
JM117	056	1	4	10	3	110	76	00
JM117	057	1	2	0	1	110	76	00
JM117	058	1	1	0	2	60	72	00
JM117	059	1	1	0	2	60	72	00
JM117	060	1	2	0	2	0	94	00
JM117	061	1	1	0	1	70	105	00
JM117	062	1	7	0	1	140	102	00
JM117	063	1	1	0	2	140	102	00
JM117	064	1	1	0	1	140	104	00
JM117	065	1	2	0	2	200	105	00
JM117	066	1	7	0	3	310	105	00
JM117	067	1	3	0	2	250	114	00
JM117	068	1	1	0	2	190	121	00
JM117	069	1	1	0	2	210	144	00
JM117	070	1	5	0	2	220	153	00
JM117	071	1	5	0	2	240	155	00
JM117	072	1	5	0	2	250	153	00
JM117	073	1	3	0	2	260	151	00
JM117	074	1	2	0	1	320	145	00
JM117	075	1	3	0	3	430	110	00
JM117	076	1	1	0	2	260	166	00
JM117	077	1	1	0	2	220	166	00
JM117	078	1	1	0	2	240	174	00
JM117	079	1	7	0	3	190	191	00

Table 14.1 - continued

```
JM117 080 1  3 14  6  170  193 00
JM117 081 1  1  0  2  180  204 00
JM117 082 1  3  0  2  160  202 00
JM117 083 1  3  0  2  180  211 00
JM117 084 1  3  0  2  100  205 00
JM117 085 1  1  0  1   80  224 00
JM117 086 1  7  0  2   60  218 00
JM117 087 1  7  0  4   30  244 00
JM117 088 1  7  0  6   50  245 00
JM117 089 1  3  0  2 3590  244 00
JM117 090 1  3  0  2   90  250 00
JM117 091 1  7  0  2  110  261 00
JM117 092 1  7  0  2  130  256 00
JM117 093 1  2  0  3  130  258 00
JM117 094 1  4 13  1  250  247 00
JM117 095 1  7  0  2  280  255 00
JM117 096 1  0  0  0 3145  300 03
JM117 097 1  0  0 15  570  200 05
JM117 098 1  0  0 15  470  175 05
JM117 099 1  0  0 15 3520  130 05
JM117 100 1  0  0 15 2910  125 05
JM117 101 1  0  0 15 1560  250 05
 3260 0452 0000 0000 0000 0000 097 000 000 101 000 000
JM117 053 2 250 150 0000 11796 06000 0198 03000 00229 05800 999 1 0800 01323020
JM117       3 673920 421431 00     300000  10 0033666 0010 0006    0    0 .01 .01 .02
JM117       4    0 .01    0 .01 .01 .16 .24 .17 .17 .14    0    0    0    0    0    0    0
JM118 001 1  3  0  3  190  138 00 100 000 0000016450 0 1
JM118 002 1  7  0  3   40  214 00
JM118 003 1  3  0  1 3480  231 00
JM118 004 1  7  0  3 3480  231 00
JM118 005 1  7  0  1 3500  163 00
JM118 006 1  7  0  1 3440  289 00
JM118 007 1  7  1  1 3450  179 00
JM118 008 1  3  0  1 3440  133 00
JM118 009 1  3  0  1 3410  158 00
JM118 010 1  2  0  1 3390  146 00
JM118 011 1  7  0  1 3390  146 00
JM118 012 1  3  0  6 3390   82 00
JM118 013 1  3  0  1 3260   69 00
JM118 014 1  3  0  3 3270   71 00
JM118 015 1  3  0  1 3210   94 00
JM118 016 1  7  0  1 3350  178 00
JM118 017 1  7  0  1 3280  299 00
JM118 018 1  3  0  1 3250  189 00
JM118 019 1  3  0  3 3110  130 00
JM118 020 1  3  0  1 3140  105 00
JM118 021 1  7  0  1 3130  108 00
JM118 022 1  4 10  3 3130   66 00
JM118 023 1  7  0  1 3010   52 00
JM118 024 1  4 13  1 3010   53 00
JM118 025 1  7  0  1 3020   68 00
JM118 026 1  4 15  3 3000   57 00
JM118 027 1  3  0  1 3040  115 00
JM118 028 1  7  0  2 3040  212 00
JM118 029 1  7  0  3 3040  203 00
JM118 030 1  7  2  2 3030  202 00
JM118 031 1  3  0  2 3000  167 00
JM118 032 1  7  0  1 3020  132 00
JM118 033 1  2  0  1 3000  166 00
JM118 034 1  2 14  1 2770   62 00
JM118 035 1  7  0  3 2660   84 00
JM118 036 1  2  0  1 2320   53 00
```

Table 14.1 - continued

JM118	037	1	3	0	1	2260	47	00
JM118	038	1	2	0	1	2110	43	00
JM118	039	1	4	13	3	2090	42	00
JM118	040	1	7	0	8	2050	45	00
JM118	041	1	2	13	3	2050	48	00
JM118	042	1	3	0	3	2050	54	00
JM118	043	1	3	0	1	2040	59	00
JM118	044	1	7	0	3	2010	56	00
JM118	045	1	7	0	3	2030	53	00
JM118	046	1	4	10	4	2000	46	00
JM118	047	1	3	0	1	2140	120	00
JM118	048	1	4	13	3	2140	120	00
JM118	049	1	3	0	1	2040	108	00
JM118	050	1	7	0	6	2030	177	00
JM118	051	1	2	0	3	1980	123	00
JM118	052	1	2	0	1	1950	84	00
JM118	053	1	3	0	1	1940	164	00
JM118	054	1	7	0	3	1910	172	00
JM118	055	1	2	0	1	1930	164	00
JM118	056	1	3	0	3	1900	164	00
JM118	057	1	4	10	3	1890	136	00
JM118	058	1	3	0	3	1870	162	00
JM118	059	1	1	0	1	1860	153	00
JM118	060	1	3	0	1	1860	153	00
JM118	061	1	2	0	3	1860	148	00
JM118	062	1	2	0	3	1840	145	00
JM118	063	1	3	0	3	1820	161	00
JM118	064	1	2	0	3	1830	182	00
JM118	065	1	3	0	3	1830	184	00
JM118	066	1	2	0	1	1810	189	00
JM118	067	1	3	0	3	1810	189	00
JM118	068	1	7	0	3	1850	123	00
JM118	069	1	3	0	3	1810	117	00
JM118	070	1	3	0	1	1800	168	00
JM118	071	1	3	0	1	1810	168	00
JM118	072	1	2	0	3	1770	161	00
JM118	073	1	1	0	3	1750	159	00
JM118	074	1	5	0	4	1710	163	00
JM118	075	1	3	0	1	1710	122	00
JM118	076	1	2	0	1	1670	154	00
JM118	077	1	2	0	1	1660	138	00
JM118	078	1	7	0	3	1660	128	00
JM118	079	1	3	0	3	1660	122	00
JM118	080	1	3	0	1	1660	112	00
JM118	081	1	3	0	3	1590	140	00
JM118	082	1	4	10	1	1580	138	00
JM118	083	1	3	0	1	1580	136	00
JM118	084	1	4	10	1	1560	135	00
JM118	085	1	3	0	2	1560	127	00
JM118	086	1	3	0	3	1560	127	00
JM118	087	1	3	0	3	1470	153	00
JM118	088	1	2	0	3	1460	153	00
JM118	089	1	3	0	3	1460	145	00
JM118	090	1	3	0	3	1440	141	00
JM118	091	1	3	0	3	1460	129	00
JM118	092	1	3	0	3	1400	140	00
JM118	093	1	7	0	3	1370	125	00
JM118	094	1	3	14	3	1360	74	00
JM118	095	1	7	0	2	1390	25	00
JM118	096	1	3	0	3	1390	25	00
JM118	097	1	7	0	3	1110	11	00
JM118	098	1	2	0	2	1000	178	00

Table 14.1 - continued

```
JM118 099 1  3  0  3 1120  152 00
JM118 100 1  3  0  3  750  118 00
JM118 053 2 010 990 1000 11811 05000 0152 05000 00171 02400 943 2 0800 01323020
JM118     3 672920 421319 00    016450  10 0607902 0010 0005 .01 .01 .04 .05   0
JM118     4   0 .02 .01   0   0 .24 .02 .16 .43 .01   0   0   0   0   0   0   0
JM119 001 1  3  0  2 3280   18 00  34 000 0000042000 0 1
JM119 002 1  0 30 15 3290   15 00
JM119 003 1  0 32 15 1120   26 00
JM119 004 1  0 32 15 1130   32 00
JM119 005 1  7  2  0 1140   51 00
JM119 006 1  0 32 15 1160   61 00
JM119 007 1  7  0  2 1250  100 00
JM119 008 1  0 32 15 1230  104 00
JM119 009 1  0 31 15 1250  112 00
JM119 010 1  0 31 15 1370  178 00
JM119 011 1  0 31 15 1390  206 00
JM119 012 1  3 13  2 1390  206 00
JM119 013 1  0 31 15 1410  298 00
JM119 014 1  0 31 15 1300  200 00
JM119 015 1  2  0  1 1550  250 00
JM119 016 1  0 30 15 1600  250 00
JM119 017 1  0 32 15 1500  535 00
JM119 018 1  3 14  1 1530  495 00
JM119 019 1  0 30 15 1540  495 00
JM119 020 1  0  0 15 1740  203 08
JM119 021 1  0 30 15 1740  226 00
JM119 022 1  0 30 15 1730  254 00
JM119 023 1  0 30 15 1730  277 00
JM119 024 1  0 30 15 1820  367 00
JM119 025 1  0 30 15 1700  418 00
JM119 026 1  3 13  1 1950  185 00
JM119 027 1  0 32 15 1980  150 00
JM119 028 1  0 31 15  850   95 00
JM119 029 1  1 13  2  640  310 00
JM119 030 1  0 30 15  230   86 00
JM119 031 1  0  0 15  330  228 08
JM119 032 1  0 30 15  330   28 00
JM119 033 1  0 31 15  140  245 00
JM119 034 1  2  0  2  200  270 00
JM119 053 2 040 065 1580 11704 04000 0015 04000 00015 02000 842 2 0800 01323020
JM119     3 672898 421202 00    420000   8 0008095 0010 0006   0 .03 .09   0   0
JM119     4   0 .03   0 .29 .21 .03   0 .06 .03   0   0   0   0   0 .18   0   0
JM120 001 1  0  0  0  247  900 02  17 000 0000041250 0 1
JM120 002 1  3 13  2  161  115 00
JM120 003 1  7  0  3  500   22 00
JM120 004 1  3 13  1 1590  218 00
JM120 005 1  4 10  3 2340    7 00
JM120 006 1  2 14  2 2140  109 00
JM120 007 1  2 13  3 2240  204 00
JM120 008 1  4 10  2 2240  232 00
JM120 009 1  3  0  2 2240  232 00
JM120 010 1  3 15  2 2270  250 00
JM120 011 1  3  0  2 1950  244 00
JM120 012 1  7  3  1 1900  233 00
JM120 013 1  7  3  3 1900  233 00
JM120 014 1  2 13  2 1990  457 00
JM120 015 1  2 13  3 2020  830 00
JM120 016 1  3  0  3 2980   30 00
JM120 017 1  2  0  3 3030  290 00
JM120 006 2 150 150 0100 11811 01000 0046 02000 00259 02800 962 2 0800 01323020
JM120     3 671930 421102 00    412500   7 0006303 0029 0012   0   0 .41 .12   0
JM120     4   0 .06 .06   0   0 .06   0 .06 .18   0   0   0   0   0   0   0   0
```

Table 14.1 - continued

```
JM122 001 1   0 31 15    40   125 00   13 000 0000040000 0 1
JM122 002 1   2 14  1   220   133 00
JM122 003 1   7  0  1   890    65 00
JM122 004 1   7  0  4  1160   148 00
JM122 005 1   7  0  4  1200   160 00
JM122 006 1   3 14  2  1220   153 00
JM122 007 1   2  0  3  1330   153 00
JM122 008 1   2  0  1  1370   155 00
JM122 009 1   2 14  3  1350   184 00
JM122 010 1   7  0  2  1360   246 00
JM122 011 1   7  0  6  1520   146 00
JM122 012 1   2 14  1  1950   101 00
JM122 013 1   7  0  8  2540   109 00
JM122 006 2 500 500 2900 11826 01500 0031 01500 00091 00260 882 4 0800 23031000
JM122     3 671430 421089 00     040000    3 0075000 0057 0015    0    0    0    0    0
JM122     4    0 .31    0    0 .08 .46    0 .15    0    0    0    0    0    0    0    0    0
JM123 001 1   4 11  2  1120    19 00   30 000 0000200000 0 1
JM123 002 1   0  0  0  1490    50 01
JM123 003 1   1 14  2   890    94 00
JM123 004 1   2  0  6   920    93 00
JM123 005 1   2  0 11   790    91 00
JM123 006 1   0 30 15   780    79 00
JM123 007 1   0 32 15   750    84 00
JM123 008 1   0 32 15  1000    98 00
JM123 009 1   2  0  2  3560    18 00
JM123 010 1   7  0  2  3560    18 00
JM123 011 1   2 14  3  3580    24 00
JM123 012 1   7  0  2    80    29 00
JM123 013 1   2  0  2  3590    68 00
JM123 014 1   2  0  2  3300    63 00
JM123 015 1   0  0  2  3370   136 08
JM123 016 1   7  0  3  2000   292 00
JM123 017 1   2 14  2  1820   371 00
JM123 018 1   3  0  2  3100   142 00
JM123 019 1   3 14  3  2440  1010 00
JM123 020 1   0  0 15  2440  1010 08
JM123 021 1   2  0  1  1600   224 00
JM123 022 1   0 33  0  3250   127 00
JM123 023 1   0 33 15  1900   484 00
JM123 024 1   0 33 15  1930   504 00
JM123 025 1   0 33 15  1910   580 00
JM123 026 1   0 33 15  1900   670 00
JM123 027 1   0 33 15  1890   760 00
JM123 028 1   0 33 15  1890   570 00
JM123 029 1   0 33 15  1880   660 00
JM123 030 1   0 33 15  1870   740 00
JM123 053 2 050 100 2700 11918 01000 0107 01000 00107 00160 483 3 0800 01323020
JM123     3 671150 421044 01     200000    7 0012000 0057 0015    0    0    0    0 .03
JM123     4    0 .13    0 .03    0 .10    0 .20 .03    0    0    0    0    0 .07 .30    0
JM125 001 1   3  0  1  2360    37 00   20 000 0000004800 0 1
JM125 002 1   0  0 15  2310    48 08
JM125 003 1   2 13  1  2270    46 00
JM125 004 1   0  0 15  2280    73 08
JM125 005 1   2  0  1  2280    73 00
JM125 006 1   0  0 15  2240    84 01
JM125 007 1   2 14  2  2230    89 00
JM125 008 1   2  0  2  2240   114 00
JM125 009 1   0  0 15  2240   114 08
JM125 010 1   0 32 15  2330   111 00
JM125 011 1   1 15  1  2350   121 00
JM125 012 1   2 13  7  2300   116 00
JM125 013 1   3 13  4  2290   117 00
```

Table 14.1 - continued

```
JM125 014 1  0  0 15 2260   125 08
JM125 015 1  3  0  1 2160   165 00
JM125 016 1  0 30 15 2300   156 00
JM125 017 1  4 13  6 2320   165 00
JM125 018 1  0  0 15 2330   163 08
JM125 019 1  0  0 15 2300   229 08
JM125 020 1  0  0 15 2330   284 08
JM125 006 2 025 150 2800 11750 00000 0015 00000 00015 00100 800 3 0800 23031000
JM125     3 671260 421078 00     090000   6 0022222 0057 0015   0   0 .20   0   0
JM125     4   0 .05 .05 .05   0    0    0 .10 .10   0    0    0    0   0 .05   0   0
JM126 001 1  0 32 15 3060    99 00  67 000 0000350000 0 1
JM126 002 1  3  0  3 3110   110 00
JM126 003 1  5  0  3 3110   123 00
JM126 004 1  3 13  3 3140   195 00
JM126 005 1  0 31  2 2920   373 00
JM126 006 1  0 30 15 2710   340 00
JM126 007 1  0 30 15 2700   310 00
JM126 008 1  0  0 15 2690    91 08
JM126 009 1  5  0  3 2350    65 00
JM126 010 1  0 30 15 2590   148 00
JM126 011 1  0 32 15 2380   233 00
JM126 012 1  0 30 15 2350   226 00
JM126 013 1  3 13  3 2360   205 00
JM126 014 1  3  0  3 2310   332 00
JM126 015 1  0 32 15 2380   323 00
JM126 016 1  0 32 15 2370   308 00
JM126 017 1  2  0  4 2370   308 00
JM126 018 1  0 30 15 2360   429 00
JM126 019 1  0  0 15 2260   515 01
JM126 020 1  0  0 15 2280   550 01
JM126 021 1  0 30 15 2170   660 00
JM126 022 1  7  2  2 2260   330 00
JM126 023 1  0 32 15 2240   337 00
JM126 024 1  0  0  0 2190   310 09
JM126 025 1  4 10  2 2180   308 00
JM126 026 1  3  0  3 1990    43 00
JM126 027 1  0 32 15 1810   139 00
JM126 028 1  0 30 15 1770   139 00
JM126 029 1  0 32 15 1810   163 00
JM126 030 1  0  0 15 1630   185 01
JM126 031 1  3  0  2 1630   179 00
JM126 032 1  2  0  2 1510   224 00
JM126 033 1  0 30 15 1520   254 00
JM126 034 1  0 30 15 1520   254 00
JM126 035 1  3 13  3 1470   202 00
JM126 036 1  0 30 15 1520   104 00
JM126 037 1  4 11  2 1430   114 00
JM126 038 1  0 32 15 1190    81 00
JM126 039 1  2 13  2 1190   249 00
JM126 040 1  3  0  3 1290   420 00
JM126 041 1  3 13  3 1310   486 00
JM126 042 1  3  0  2 1310   492 00
JM126 043 1  0 30 15 1340   770 00
JM126 044 1  2  0 11 1270   890 00
JM126 045 1  3 13  3 1110   402 00
JM126 046 1  2  0  4  550   288 00
JM126 047 1  3  0  3  330   235 00
JM126 048 1  0 32 15  310   246 00
JM126 049 1  2 13  2  580  1210 00
JM126 050 1  3  0  2  500  1400 00
JM126 051 1  3  0  2  500  1400 00
JM126 052 1  3  0  2  500  1400 00
```

Table 14.1 - continued

```
JM126 053 1  3  0  2  500 1400 00
JM125 054 1  7  0  2  430 1230 00
JM126 055 1  2  0  2  430 1230 00
JM126 056 1  3  0  2  350 1780 00
JM126 057 1  4  0  3  350 1780 00
JM126 058 1  7  2  2  350 1765 00
JM126 059 1  4 11  2   60  112 00
JM125 060 1  2  0  3   80  167 00
JM126 061 1  0  0 15  100  249 08
JM126 062 1  0  0 15   60  285 04
JM126 063 1  3  0  3   10  340 00
JM126 064 1  3 13  3   10  342 00
JM126 065 1  3  0  5 3590  342 00
JM126 066 1  3  0  5 3590  342 00
JM126 067 1  4  0  2 3330  545 00
JM126 053 2 040 075 2900 11933 01500 0183 01500 00183 00120 629 2 0800 01323020
JM126     3 670800 421043 03    350000  11 0019142 0057 0016   0 .03 .12 .01 .03
JM126     4   0   0   0 .16 .01 .01   0 .09 .22 .03   0 .03   0   0 .13   0   0
JM129 001 1  7  3  3 3590  384 00  27 000 0000011440 0 1
JM129 002 1  2 13  2 3550  345 00
JM129 003 1  3  0  6 3520  296 00
JM129 004 1  3  0  1 3490  336 00
JM129 005 1  2  0  2 3370  200 00
JM129 006 1  3  0  2 3360  205 00
JM129 007 1  3 13  2 3360  205 00
JM129 008 1  2 13  3 3360  218 00
JM129 009 1  2  0  3 3360  210 00
JM129 010 1  2  0  3 3360  210 00
JM129 011 1  3  0  3 3350  210 00
JM129 012 1  3 14  2 3250  173 00
JM129 013 1  7  0  3 3120  142 00
JM129 014 1  4 13  3 3080  210 00
JM129 015 1  4 10  2 2850  183 00
JM129 016 1  3  0  3 2590   96 00
JM129 017 1  1 13  2 2550  108 00
JM129 018 1  2  0  5 2540  116 00
JM129 019 1  3  0 11 2700  105 00
JM129 020 1  2  0  6 2760  220 00
JM129 021 1  3  0  2 2770  225 00
JM129 022 1  1  0  1 2720  230 00
JM129 023 1  1 13  1 2720  235 00
JM129 024 1  3  0  2 2720  240 00
JM129 025 1  2 13  1 2700  215 00
JM129 026 1  3  0  3 2700  215 00
JM129 027 1  3  0  6 3020   80 00
JM129 053 2 040 040 3000 11796 00650 0031 00650 00031 00040 718 2 0800 01323020
JM129     3 670300 421011 00    225000   7 0012000 0038 0013   0   0 .30 .04   0
JM129     4   0 .04   0   0   0 .04 .04 .19 .37   0   0   0   0   0   0   0   0
JM130 001 1  4 13  2 1860  185 00 109 000 0000154560 0 9
JM130 002 1  0 30 15 1790  140 00
JM130 003 1  0 30 15 1720   94 00
JM130 004 1  0 30 15 1340  185 00
JM130 005 1  3  0  2 1430  133 00
JM130 006 1  3  0  2 1410  118 00
JM130 007 1  0 32 15 1420  111 00
JM130 008 1  3  0  3 1390  107 00
JM130 009 1  0 30 15 1360   88 00
JM130 010 1  0  0 15 1240  145 08
JM130 011 1  1  0 11 1200  148 00
JM130 012 1  0 31 15 1200  139 00
JM130 013 1  1  0  2 1120  178 00
JM130 014 1  1  0  2 1120  163 00
```

Table 14.1 - continued

JM130	015	1	3	0	3	1090	163	00
JM130	016	1	0	30	15	1060	172	00
JM130	017	1	0	30	15	820	214	00
JM130	018	1	0	0	15	720	237	01
JM130	019	1	0	0	15	650	236	01
JM130	020	1	0	30	15	650	236	00
JM130	021	1	0	30	15	600	276	00
JM130	022	1	2	0	2	1550	244	00
JM130	023	1	0	0	15	420	180	01
JM130	024	1	0	30	15	460	149	00
JM130	025	1	0	30	15	400	129	00
JM130	026	1	0	0	15	560	127	01
JM130	027	1	0	0	15	600	112	01
JM130	028	1	0	0	15	660	104	01
JM130	029	1	0	0	15	820	111	01
JM130	030	1	0	32	15	1080	57	00
JM130	031	1	4	13	3	140	540	00
JM130	032	1	3	0	2	90	406	00
JM130	033	1	3	0	2	3500	408	00
JM130	034	1	0	30	15	40	348	00
JM130	035	1	3	0	2	3590	305	00
JM130	036	1	3	0	2	3430	313	00
JM130	037	1	1	0	2	3300	249	00
JM130	038	1	3	0	2	70	240	00
JM130	039	1	2	0	2	90	128	00
JM130	040	1	3	0	2	170	65	00
JM130	041	1	3	0	2	190	52	00
JM130	042	1	3	0	2	3340	61	00
JM130	043	1	3	0	2	3200	183	00
JM130	044	1	0	32	15	2730	327	00
JM130	045	1	3	0	2	2680	276	00
JM130	046	1	3	0	2	2640	273	00
JM130	047	1	3	0	2	2760	176	00
JM130	048	1	3	0	2	2760	176	00
JM130	049	1	3	0	2	2760	176	00
JM130	050	1	3	0	2	2760	176	00
JM130	051	1	3	0	2	2740	180	00
JM130	052	1	2	0	2	2740	180	00
JM130	053	1	3	0	2	2570	180	00
JM130	054	1	3	0	2	2560	158	00
JM130	055	1	3	0	2	2560	158	00
JM130	056	1	2	0	2	2540	155	00
JM130	057	1	0	31	15	2540	146	00
JM130	058	1	2	0	2	2540	146	00
JM130	059	1	3	0	2	2610	136	00
JM130	060	1	3	0	2	2610	136	00
JM130	061	1	3	0	2	2610	136	00
JM130	062	1	3	0	2	2510	168	00
JM130	063	1	3	0	2	2510	168	00
JM130	064	1	0	32	15	2580	113	00
JM130	065	1	2	0	2	2560	112	00
JM130	066	1	1	0	2	2560	112	00
JM130	067	1	3	0	2	2490	104	00
JM130	068	1	3	0	2	2490	104	00
JM130	069	1	2	0	2	2470	121	00
JM130	070	1	3	0	2	2480	122	00
JM130	071	1	3	0	2	2440	146	00
JM130	072	1	3	0	2	2420	164	00
JM130	073	1	3	0	1	2420	164	00
JM130	074	1	3	0	3	2400	162	00
JM130	075	1	3	0	2	2380	170	00
JM130	076	1	3	0	2	2420	203	00

Table 14.1 - continued

```
JM130 077 1  2  0  2 2370  190 00
JM130 078 1  3  0  2 2310  180 00
JM130 079 1  2  0  3 2310  180 00
JM130 080 1  3  0  2 2340  247 00
JM130 081 1  2  0  2 2390  317 00
JM130 082 1  3  0  3 2290  317 00
JM130 083 1  3  0  2 2290  285 00
JM130 084 1  2  0  2 2270  290 00
JM130 085 1  3  0  1 2210  286 00
JM130 086 1  2  0  2 2210  265 00
JM130 087 1  3  0  2 2220  248 00
JM130 088 1  3  0  2 2210  224 00
JM130 089 1  3  0  2 2260  220 00
JM130 090 1  3  0  2 2270  192 00
JM130 091 1  3  0  2 2100  253 00
JM130 092 1  3  0  2 2080  242 00
JM130 093 1  3 14  2 2070  201 00
JM130 094 1  3  0  2 1980  181 00
JM130 095 1  3  0  2 1980  175 00
JM130 096 1  3  0  2 1970  169 00
JM130 097 1  3  0  2 2040  152 00
JM130 098 1  3  0  2 1910  142 00
JM130 099 1  2  0  3 2190   86 00
JM130 100 1  0 32 15 2190   86 00
JM130 101 1  3  0  2 2320   86 00
JM130 102 1  3  0  2 2380  102 00
JM130 103 1  3  0  2 2380  102 00
JM130 104 1  3  0  2 2470  109 00
JM130 105 1  3  0  2 2470  109 00
JM130 106 1  3  0  3 2470  109 00
JM130 107 1  2  0  2 2700   58 00
JM130 108 1  0  0 15  960  222 01
JM130 109 1  0  0 15  990  236 01
 2380 0730 0000 0000 0000 0000 031 000 000 109 000 000
JM130 006 2 010 010 0900 11727 01100 0031 01100 00035 00140 747 4 0800 23031000
JM130     3 670140 421021 09    154560   7 0069228 0038 0013   0   0 .02   0   0
JM130     4   0 .01   0 .10 .02   0 .05 .13 .54   0   0   0   0   0 .05   0   0
JM131 001 1  3 14  2 1480  208 00  18 000 0000640000 0 1
JM131 002 1  7  2  2 1480  132 00
JM131 003 1  3  0  2 1480   60 00
JM131 004 1  0  0 15 1330  230 08
JM131 005 1  0  0 15 1360  308 08
JM131 006 1  2  0  2  120  337 00
JM131 007 1  3  0  2  170  590 00
JM131 008 1  7  0  1  240  600 00
JM131 009 1  0  0 15  200  860 08
JM131 010 1  2  0  2  100  870 00
JM131 011 1  0  0 15   50 1150 00
JM131 012 1  1 13  2 3570 1180 00
JM131 013 1  3  0  2 3540  520 00
JM131 014 1  3 13  2  330  850 00
JM131 015 1  1  0  2  200 1020 00
JM131 016 1  0 31 15  200 1290 00
JM131 017 1  3  0  4  200 1610 00
JM131 018 1  0 30 15 3560 1200 00
JM131 006 2 015 025 3000 11811 00500 0031 00500 00031 00100 612 2 0800 23031000
JM131     3 670070 420951 00    640000   8 0002812 0010 0006   0 .06 .11   0   0
JM131     4   0 .06   0 .06 .06 .06 .06 .11 .22   0   0   0   0   0   0   0   0
JM132 001 1  5  0  6 3500   12 00  95 000 0000005800 0 1
JM132 002 1  3  0  2 3240   56 00
JM132 003 1  0  0 15 3210  110 01
JM132 004 1  3  0  2 3240  104 00
```

Table 14.1 - continued

JM132	005	1	3	0	2	3370	97	00
JM132	006	1	0	31	15	3380	108	00
JM132	007	1	3	0	2	3280	177	00
JM132	008	1	3	0	2	3290	178	00
JM132	009	1	0	0	15	3180	149	01
JM132	010	1	0	0	15	3160	131	01
JM132	011	1	0	30	15	3090	134	00
JM132	012	1	2	0	3	2980	120	00
JM132	013	1	3	0	6	2540	109	00
JM132	014	1	3	0	5	2310	59	00
JM132	015	1	3	0	6	2300	65	00
JM132	016	1	3	0	2	2300	81	00
JM132	017	1	0	30	15	2300	98	00
JM132	018	1	3	0	2	2110	123	00
JM132	019	1	3	0	2	2170	69	00
JM132	020	1	3	0	15	2200	69	00
JM132	021	1	0	0	15	2200	70	08
JM132	022	1	3	0	2	2220	67	00
JM132	023	1	0	0	15	2240	48	08
JM132	024	1	0	31	15	2090	144	00
JM132	025	1	3	0	2	2060	127	00
JM132	026	1	3	0	2	1940	158	00
JM132	027	1	3	0	6	1870	149	00
JM132	028	1	0	0	15	1840	143	01
JM132	029	1	3	0	2	1800	180	07
JM132	030	1	3	0	2	1800	180	07
JM132	031	1	3	0	6	1800	180	07
JM132	032	1	0	0	15	1820	112	01
JM132	033	1	7	0	6	1740	36	00
JM132	034	1	3	0	2	1740	131	00
JM132	035	1	3	0	2	1720	144	00
JM132	036	1	7	0	2	1720	113	00
JM132	037	1	0	30	15	1700	102	00
JM132	038	1	0	30	15	1630	51	00
JM132	039	1	0	0	15	1510	139	08
JM132	040	1	2	0	2	1480	183	00
JM132	041	1	3	0	2	1470	194	00
JM132	042	1	3	0	2	1480	223	00
JM132	043	1	3	0	2	1450	41	00
JM132	044	1	3	0	2	1440	37	00
JM132	045	1	5	0	2	1220	43	00
JM132	046	1	2	0	2	1180	67	00
JM132	047	1	3	0	2	1120	265	00
JM132	048	1	3	0	2	1060	247	00
JM132	049	1	7	0	2	1030	287	00
JM132	050	1	2	0	2	950	296	00
JM132	051	1	3	0	6	740	222	00
JM132	052	1	0	30	15	240	52	00
JM132	053	1	3	0	2	240	52	00
JM132	054	1	3	0	6	240	52	00
JM132	055	1	3	0	2	3580	55	00
JM132	056	1	1	0	2	3510	53	00
JM132	057	1	3	0	2	3510	64	00
JM132	058	1	0	30	15	3040	179	00
JM132	059	1	5	0	2	3070	180	00
JM132	060	1	0	31	15	3020	273	00
JM132	061	1	0	30	15	3250	390	00
JM132	062	1	3	0	2	3320	238	00
JM132	063	1	3	0	2	3350	257	00
JM132	064	1	0	0	15	3460	314	08
JM132	065	1	5	0	2	3460	314	00
JM132	066	1	0	0	15	3490	274	01

Table 14.1 - continued

```
JM132 067 1  3  0  2 3540  262 00
JM132 068 1  3  0  2 3550  276 00
JM132 069 1  0 30 15 3560  272 00
JM132 070 1  0  0 15 3580  283 01
JM132 071 1  3  0  2    0  257 00
JM132 072 1  0  0 15   30  263 08
JM132 073 1  0 31 15    0  205 00
JM132 074 1  0 32 15  100  203 00
JM132 075 1  3  0  1    0  107 00
JM132 076 1  3  0  2  140  137 00
JM132 077 1  3  0  2  230  140 00
JM132 078 1  0  0 15  180  160 01
JM132 079 1  0 30 15  180  160 00
JM132 080 1  7  3  1  190  185 00
JM132 081 1  0  0 15  510  235 08
JM132 082 1  0 30 15  260  313 00
JM132 083 1  0  0 15  260  323 08
JM132 084 1  0  0 15  210  358 01
JM132 085 1  4 13  1  210  358 00
JM132 086 1  0 30 15  210  358 00
JM132 087 1  0 31 15  170  385 00
JM132 088 1  0  0 15  180  407 01
JM132 089 1  0 30 15  150  407 00
JM132 090 1  0  0 15  150  430 01
JM132 091 1  0  0 15  130  465 01
JM132 092 1  0 31 15  130  465 00
JM132 093 1  0  0  2  130  480 08
JM132 094 1  7  2  2   30  408 00
JM132 095 1  0  0 15  200  400 06
JM132 006 2 010 500 2500 11781 00600 0016 00600 00016 00190 813 2 0800 23031000
JM132     3 670480 421047 06    386400  10 0024844 0057 0015   0 .01 .02   0   0
JM132     4   0   0   0 .13 .06 .03 .01 .04 .42 .04   0   0   0   0 .01   0   0
JM133 001 1  0 30 15 1600  221 00 101 000 0000070000 0 9
JM133 002 1  0 30 15 1340  200 00
JM133 003 1  0 31 15 1320  206 00
JM133 004 1  0 30 15 1240  203 00
JM133 005 1  7  0  2 1170  220 00
JM133 006 1  2 14  1 1180  156 00
JM133 007 1  0 30 15 1270  145 00
JM133 008 1  0 30 15 1300  157 00
JM133 009 1  7  2  2 1320  144 00
JM133 010 1  3  0  3 1260  129 00
JM133 011 1  0  0  0 1240   96 01
JM133 012 1  0  0  0 1420  122 01
JM133 013 1  0  0  0 1680   61 01
JM133 014 1  0  0  0 1650   35 01
JM133 015 1  0  0  0 1910   76 01
JM133 016 1  0  0  0 2280   77 01
JM133 017 1  0 31 15 2510   58 00
JM133 018 1  1  0  2 2800  113 00
JM133 019 1  1  0  2 2610  306 00
JM133 020 1  2  0  2 2660  307 00
JM133 021 1  3  0  1 2780  350 00
JM133 022 1  2  0  2 2790  359 00
JM133 023 1  0 30 15 2850  468 00
JM133 024 1  2  0  2 2850  468 00
JM133 025 1  3  0  2 2800  309 00
JM133 026 1  2  0  2 2910  176 00
JM133 027 1  0 30 15 2950  167 00
JM133 028 1  1  0  2 3040  270 00
JM133 029 1  7  0  3 3120  219 00
JM133 030 1  0 32 15 3260  193 00
```

Table 14.1 - continued

JM133	031	1	7	0	2	3390	165	00
JM133	032	1	0	30	15	3460	143	00
JM133	033	1	3	0	2	3510	143	00
JM133	034	1	1	0	2	3520	141	00
JM133	035	1	3	0	2	180	165	00
JM133	036	1	3	0	2	200	175	00
JM133	037	1	3	0	2	210	181	00
JM133	038	1	3	0	2	230	182	00
JM133	039	1	3	0	2	240	190	00
JM133	040	1	3	0	2	220	164	00
JM133	041	1	0	31	15	200	157	00
JM133	042	1	7	0	2	210	151	00
JM133	043	1	3	0	2	190	139	00
JM133	044	1	3	0	2	150	140	00
JM133	045	1	5	0	2	240	130	00
JM133	046	1	0	0	0	230	68	01
JM133	047	1	3	0	1	310	96	00
JM133	048	1	5	0	1	430	115	00
JM133	049	1	5	0	1	460	117	00
JM133	050	1	0	0	0	430	122	01
JM133	051	1	2	0	2	450	133	00
JM133	052	1	5	0	2	470	126	00
JM133	053	1	0	0	0	540	125	01
JM133	054	1	3	0	2	550	128	00
JM133	055	1	0	0	0	600	122	01
JM133	056	1	0	30	15	620	113	00
JM133	057	1	0	0	0	670	138	01
JM133	058	1	0	30	15	610	149	00
JM133	059	1	4	0	6	480	164	00
JM133	060	1	0	30	15	880	201	00
JM133	061	1	0	0	15	870	153	01
JM133	062	1	0	30	15	890	145	00
JM133	063	1	0	0	0	1110	103	01
JM133	064	1	0	0	0	1140	13	01
JM133	065	1	2	0	2	2660	176	00
JM133	066	1	2	0	2	2660	176	00
JM133	067	1	0	30	15	2660	172	00
JM133	068	1	5	0	3	2670	162	00
JM133	069	1	3	0	2	2670	165	00
JM133	070	1	2	0	2	2680	174	00
JM133	071	1	2	0	1	2700	165	00
JM133	072	1	0	0	0	2730	194	01
JM133	073	1	1	0	1	2780	238	00
JM133	074	1	5	0	1	2910	233	00
JM133	075	1	5	0	3	2910	233	00
JM133	076	1	0	0	0	2940	218	01
JM133	077	1	0	30	15	2980	294	00
JM133	078	1	1	0	2	2150	247	00
JM133	079	1	7	0	2	1430	278	00
JM133	080	1	0	30	15	1380	267	00
JM133	081	1	4	10	2	1370	262	00
JM133	082	1	1	0	2	1350	231	00
JM133	083	1	0	0	0	1350	192	01
JM133	084	1	2	0	2	1350	118	00
JM133	085	1	1	0	1	1470	90	00
JM133	086	1	0	32	15	1230	123	00
JM133	087	1	2	0	2	1060	126	00
JM133	088	1	1	0	2	1190	243	00
JM133	089	1	0	0	0	1260	221	01
JM133	090	1	0	0	0	1280	304	01
JM133	091	1	0	30	15	1160	350	00
JM133	092	1	0	0	0	1120	280	01

Table 14.1 - continued

```
JM133 093 1  0  0  0  990   312 01
JM133 094 1  3  0  2  960   215 00
JM133 095 1  0 30 15  930   289 00
JM133 096 1  5  0  2  890   297 00
JM133 097 1  3  0  2  890   300 00
JM133 098 1  2  0  2  890   301 00
JM133 099 1  0  0  0  690   353 01
JM133 100 1  0  0  0  660   382 01
JM133 101 1  0  0  0  180   300 01
 3550 0470 0000 0000 0000 0000 065 000 000 101 000 000
JM133 006 2 030 060 0900 11796 00300 0031 00300 00031 00250 816 3 0800 23031000
JM133       3 670230 421049 24     070000  11 0145714 0038 0013   0 .01    0 .01    0
JM133       4    0 .01    0 .17 .03 .05 .09 .12 .17 .08   0 .01    0    0 .02    0    0
JM134 001 1  3  0  0  280    17 00 150 000 0000300000 0 9
JM134 002 1  0 30 15  440    46 00
JM134 003 1  0  0 15  380    54 08
JM134 004 1  0 32 15  300    52 00
JM134 005 1  0 32 15  280    55 00
JM134 006 1  0 31 15  340    44 00
JM134 007 1  0  0 15  310    36 08
JM134 008 1  7  0  2  180    63 08
JM134 009 1  0 30 15   20    61 00
JM134 010 1  3 14  1  600   116 00
JM134 011 1  0 31 15  540   141 00
JM134 012 1  3  0  1  520   147 00
JM134 013 1  0 30 15  460   137 00
JM134 014 1  0 32 15  460   134 00
JM134 015 1  0 32 15  400   121 00
JM134 016 1  0  0 15  590   161 08
JM134 017 1  3  0  2  690   223 00
JM134 018 1  3 13  7  670   224 00
JM134 019 1  0  0 15  660   231 08
JM134 020 1  0  0 15  720   257 08
JM134 021 1  0 32 11  230   165 00
JM134 022 1  4 10  3   90   114 00
JM134 023 1  2  0  2 3590   137 00
JM134 024 1  0 31 15    0   138 00
JM134 025 1  0 30 15    0   137 00
JM134 026 1  4  0  7 3590   156 00
JM134 027 1  2  0  3 3580   176 00
JM134 028 1  0 31 15 3460   154 00
JM134 029 1  4 13  3 3490   126 00
JM134 030 1  0 30 15 3490   118 00
JM134 031 1  0  0 15 3490   125 08
JM134 032 1  0 32 15 3370   149 00
JM134 033 1  0 31 15 3350   147 00
JM134 034 1  0 30 15 3240   149 00
JM134 035 1  0 32 15 3280   190 00
JM134 036 1  0  0 15 3210   178 08
JM134 037 1  3  0  1 3160   177 00
JM134 038 1  2  0  1 3100   199 00
JM134 039 1  0  0 15 3090   147 08
JM134 040 1  0  0 15 2970   149 08
JM134 041 1  0  0 15 2940   149 08
JM134 042 1  3 13  1 2900   157 00
JM134 043 1  0 31 15 2880   155 00
JM134 044 1  7  0  2 2910   140 00
JM134 045 1  2  0  2 2840   179 00
JM134 046 1  0 32 15 2820   184 00
JM134 047 1  0 32 15 2770   189 00
JM134 048 1  0 30 15 2770   195 00
JM134 049 1  2  0 15 2790   225 00
```

Table 14.1 - continued

JM134	050	1	0	32	15	2670	280	00
JM134	051	1	0	32	15	2670	335	00
JM134	052	1	0	0	15	2660	379	08
JM134	053	1	0	0	15	2710	379	08
JM134	054	1	1	0	2	2540	580	00
JM134	055	1	0	0	15	2540	585	08
JM134	056	1	0	30	15	2810	86	00
JM134	057	1	0	0	15	2900	89	08
JM134	058	1	0	0	15	3030	79	08
JM134	059	1	2	0	1	2960	87	00
JM134	060	1	7	0	2	3060	76	00
JM134	061	1	0	32	15	3320	56	00
JM134	062	1	0	30	15	3320	56	00
JM134	063	1	7	2	1	3390	69	00
JM134	064	1	2	14	3	3320	60	00
JM134	065	1	0	30	15	3320	62	00
JM134	066	1	0	30	15	2740	800	00
JM134	067	1	3	0	1	2460	33	00
JM134	068	1	4	11	3	2240	79	00
JM134	069	1	0	30	15	2290	159	00
JM134	070	1	7	0	2	2290	160	00
JM134	071	1	2	0	2	2590	82	00
JM134	072	1	0	31	15	2720	85	00
JM134	073	1	0	30	15	2790	57	00
JM134	074	1	3	0	2	2790	65	00
JM134	075	1	0	30	15	2790	79	00
JM134	076	1	0	30	2	2740	484	00
JM134	077	1	0	32	15	2540	540	00
JM134	078	1	0	31	15	3150	10	00
JM134	079	1	0	31	15	3170	50	00
JM134	080	1	7	2	2	3380	243	00
JM134	081	1	0	31	15	3430	255	00
JM134	08	1	0	30	15	3500	307	00
JM134	083	1	0	30	15	3530	302	00
JM134	084	1	0	31	15	3570	328	00
JM134	085	1	0	0	2	40	330	08
JM134	086	1	0	0	2	70	265	08
JM134	087	1	0	30	15	180	132	00
JM134	088	1	0	31	15	280	136	00
JM134	089	1	2	0	3	290	170	00
JM134	090	1	3	0	3	270	177	00
JM134	091	1	3	0	2	280	225	00
JM134	092	1	3	0	1	220	269	00
JM134	093	1	0	30	15	240	405	00
JM134	094	1	3	0	6	430	189	00
JM134	095	1	0	0	15	370	241	08
JM134	096	1	3	0	2	400	235	00
JM134	097	1	0	31	15	400	244	00
JM134	098	1	0	0	2	470	281	08
JM134	099	1	0	0	15	440	298	08
JM134	100	1	4	11	3	440	308	00
JM134	101	1	0	0	2	470	340	08
JM134	102	1	0	31	2	550	236	00
JM134	103	1	0	0	15	500	510	08
JM134	104	1	2	0	7	530	560	00
JM134	105	1	3	0	1	580	291	00
JM134	106	1	0	30	15	640	270	00
JM134	107	1	2	0	2	640	279	00
JM134	108	1	0	0	15	580	338	08
JM134	109	1	0	30	15	550	415	00
JM134	110	1	0	30	15	550	438	00
JM134	111	1	2	0	2	550	435	00

Table 14.1 - continued

```
JM134 112 1  0 31 15  550   467 00
JM134 113 1  3  0  2  570   500 00
JM134 114 1  0 30 15  580   500 00
JM134 115 1  0 30 15  700   306 00
JM134 116 1  0  0 15  720   320 08
JM134 117 1  0  0  2  750   306 08
JM134 118 1  0  0 15  760   356 08
JM134 119 1  0 31 15  650   365 00
JM134 120 1  0 30 15  670   375 00
JM134 121 1  0 32 15  620   395 00
JM134 122 1  3  0  1  670   408 00
JM134 123 1  2 15  1  660   450 00
JM134 124 1  0 30 15  650   690 00
JM134 125 1  2  0  3  600   830 00
JM134 126 1  0 30 15  660   800 00
JM134 127 1  0  0  0  660   770 01
JM134 128 1  2  0  2  690   840 00
JM134 129 1  0  0  0  740  1000 01
JM134 130 1  5  0  7  720   740 00
JM134 131 1  3 15  3  720   730 00
JM134 132 1  0 30 15  700   650 00
JM134 133 1  2  0  2  690   647 00
JM134 134 1  0 30 15  690   647 00
JM134 135 1  7  0  6  490    36 00
JM134 136 1  0 32 15  410    11 00
JM134 137 1  3  0  5  780    10 00
JM134 138 1  0  0  0  830    18 01
JM134 139 1  7  0  5  820   164 00
JM134 140 1  4 13  2  860   160 00
JM134 141 1  0 32 15  850   131 00
JM134 142 1  0 30 15  910   474 00
JM134 143 1  0 30 15  900   335 00
JM134 144 1  2  0  2  970   142 00
JM134 145 1  0  0  2  980   120 08
JM134 146 1  7  0  5 1010   136 00
JM134 147 1  0  0 15 1120   217 08
JM134 148 1  3  0  2 1190   294 00
JM134 149 1  0 30 15 1110    73 00
JM134 150 1  0 30 15 1220    65 00
 1010 1230 0000 0000 0000 0000 067 000 000 150 000 000
JM134 022 2 025 025 1200 11750 01300 0031 01300 00031 00170 747 2 1200 22121020
JM134       3 671520 421142 07     300000   14 0050000 0019 0014    0 .[illegible]  .03 .01 .01
JM134       4    0 .01 .01 .22 .11 .05 .01 .10 .11 .01    0 .01    0    0 .11    0    0
JM151 001 1  7  1  2  140   117 00 101 000 0000015360 0 1
JM151 002 1  7  0  1  100   119 00
JM151 003 1  7  0  1   90   123 00
JM151 004 1  3 14  2   40   125 00
JM151 005 1  1  0  1   40   125 00
JM151 006 1  1 14  1 3550   143 00
JM151 007 1  7  1  1 3520   160 00
JM151 008 1  7  1  1 3510   183 00
JM151 009 1  3  0  1 3490   204 00
JM151 010 1  2 14  1 3500   233 00
JM151 011 1  3  0  1    0   241 00
JM151 012 1  7  0  1 3580   227 00
JM151 013 1  7  0  2 3580   226 00
JM151 014 1  7  2  2 3570   207 00
JM151 015 1  4 10  1 3550   204 00
JM151 016 1  1  0  1 3590   192 00
JM151 017 1  0  0  2    0   193 08
JM151 018 1  1  0  1 3540   108 00
JM151 019 1  7  2  2 3490   120 00
```

Table 14.1 - continued

JM151	020	1	0	0	15	3400	127	09
JM151	021	1	0	0	15	3310	128	09
JM151	022	1	0	0	15	3260	127	09
JM151	023	1	0	0	15	3220	125	09
JM151	024	1	0	0	15	3190	115	09
JM151	025	1	0	0	15	3170	108	09
JM151	026	1	0	0	15	3230	95	09
JM151	027	1	0	0	15	3300	87	09
JM151	028	1	0	0	15	3410	91	09
JM151	029	1	0	0	15	3500	120	09
JM151	030	1	0	0	15	3310	106	02
JM151	031	1	7	2	2	3500	80	00
JM151	032	1	7	1	1	3450	250	00
JM151	033	1	2	14	1	3460	275	00
JM151	034	1	4	10	2	3460	310	00
JM151	035	1	7	0	1	3240	188	00
JM151	036	1	4	13	1	3300	181	00
JM151	037	1	4	13	1	3290	177	00
JM151	038	1	3	0	1	3300	169	00
JM151	039	1	4	13	1	3320	181	00
JM151	040	1	7	0	1	3340	173	00
JM151	041	1	7	2	14	3360	179	00
JM151	042	1	3	0	1	3400	184	00
JM151	043	1	1	0	3	3390	216	00
JM151	044	1	4	10	1	3210	201	00
JM151	045	1	2	14	1	3200	197	00
JM151	046	1	4	13	14	3080	188	00
JM151	047	1	4	13	1	3070	181	00
JM151	048	1	2	14	14	3100	185	00
JM151	049	1	4	13	3	3050	164	00
JM151	050	1	1	14	1	3020	161	00
JM151	051	1	1	14	3	3010	157	00
JM151	052	1	7	0	1	3050	118	00
JM151	053	1	7	0	1	3080	123	00
JM151	054	1	7	2	2	3060	142	00
JM151	055	1	3	14	1	2790	149	00
JM151	056	1	3	0	2	2720	153	00
JM151	057	1	1	14	1	2710	137	00
JM151	058	1	2	14	1	2680	126	00
JM151	059	1	7	0	1	2660	125	00
JM151	060	1	4	13	1	2550	140	00
JM151	061	1	4	10	1	2560	163	00
JM151	062	1	3	0	1	2470	431	00
JM151	063	1	1	13	1	2460	221	00
JM151	064	1	4	13	2	2420	193	00
JM151	065	1	3	14	1	2130	177	00
JM151	066	1	3	0	1	2140	161	00
JM151	067	1	1	14	1	2150	163	00
JM151	068	1	4	13	2	2100	137	00
JM151	069	1	3	14	1	1990	164	00
JM151	070	1	1	14	1	1980	138	00
JM151	071	1	7	0	1	1950	125	00
JM151	072	1	3	0	2	2050	116	00
JM151	073	1	3	14	1	2020	97	00
JM151	074	1	3	14	1	2100	79	00
JM151	075	1	7	2	2	1920	92	00
JM151	076	1	2	14	3	1900	156	00
JM151	077	1	3	14	5	1890	149	00
JM151	078	1	7	1	1	1890	142	00
JM151	079	1	0	0	15	1770	140	08
JM151	080	1	3	0	1	1740	137	00
JM151	081	1	3	0	2	1700	139	00

Table 14.1 - continued

```
JM151  082 1   7   2   2 1690   131 00
JM151  083 1   1   0   2 1790   127 00
JM151  084 1   0   0  15 1850   117 01
JM151  085 1   3   0   2 1820    80 00
JM151  086 1   7   2   2 1690    98 00
JM151  087 1   7   1  14 1650   101 00
JM151  088 1   2  14   2 1600   131 00
JM151  089 1   3   0   2 1740    77 00
JM151  090 1   1   0   1 1540    70 00
JM151  091 1   3  14   1 1790    50 00
JM151  092 1   2  14   1 1230    30 00
JM151  093 1   7   0   2 1270    63 00
JM151  094 1   7   2   2 1260    86 00
JM151  095 1   3   0   2 1180    76 00
JM151  096 1   7   0   1 1100    35 00
JM151  097 1   3   0   1  740    43 00
JM151  098 1   7   1   1  590    55 00
JM151  099 1   3  14   1  420    80 00
JM151  100 1   7   2   2  430    92 00
JM151  101 1   7   0   1  330   101 00
JM151  006 2 250 250 2350 11857 03340 0092 15000 00259 00200 905 2 0800 23031000
JM151      3 673390 421818 01    015360    7 0598958 0010 0009 .07 .10 .10 .04   0
JM151      4   0 .23   0   0   0 .13 .06   0 .14   0   0   0   0   0   0   0   0
JM154  001 1   7   2   2 1560   300 00   63 000 0000046080 0 1
JM154  002 1   2  14   1 1580   308 00
JM154  003 1   7   0   1 1600   301 00
JM154  004 1   1   0   3 1630   288 00
JM154  005 1   3   0   1 1330   214 00
JM154  006 1   7   4   1 1860   313 00
JM154  007 1   3   0   3 1870   307 00
JM154  008 1   0  32  15 1940   203 00
JM154  009 1   4  13   3 2100   208 00
JM154  010 1   7   0   3 2320   273 00
JM154  011 1   1   0   1 2360   286 00
JM154  012 1   7   2   1 2450   185 00
JM154  013 1   7   1   1 2460   137 00
JM154  014 1   2  14   1 2470   141 00
JM154  015 1   2  14   1 2300   118 00
JM154  016 1   2  14   1 2310   106 00
JM154  017 1   4   0  14 2580   220 00
JM154  018 1   3   0   1 2620   229 00
JM154  019 1   1   0   1 2660   243 00
JM154  020 1   2  14   1 2630   177 00
JM154  021 1   2  14   1 2640   159 00
JM154  022 1   7   1   1 2680   153 00
JM154  023 1   1  14   1 2780   150 00
JM154  024 1   4  13   1 2790   141 00
JM154  025 1   2  14   1 3010   141 00
JM154  026 1   7   2   2 3040   174 00
JM154  027 1   0  32   1 3080   260 00
JM154  028 1   2  13   1 3100   305 00
JM154  029 1   1  14   3 3250   330 00
JM154  030 1   7   2   2 3240   343 00
JM154  031 1   7   4   1 3300   410 00
JM154  032 1   7   2  14 3310   339 00
JM154  033 1   7   0   1 3280   322 00
JM154  034 1   1   0   3 3280   298 00
JM154  035 1   7   0   1 3370   345 00
JM154  036 1   1  14   1 3200   255 00
JM154  037 1   2  14   2 3180   199 00
JM154  038 1   7   2   2 3160   201 00
JM154  039 1   7   0   1 3160   189 00
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Table 14.1 - continued

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JM154 040 1   i 14   1 3240   177 00
JM154 041 1   4 13   1 3220   160 00
JM154 042 1   2 14   1 3170   113 00
JM154 043 1   0 32   1 2820    84 00
JM154 044 1   2 14   1 2820    84 00
JM154 045 1   7  0   3 2810    83 00
JM154 046 1   4 13  14 2900    68 00
JM154 047 1   3  0   1 2400    50 00
JM154 048 1   3  0   1 2410    48 00
JM154 049 1   2  0   1 2210    35 00
JM154 050 1   7  0   1  430    37 00
JM154 051 1   1 14   1  570    73 00
JM154 052 1   2 14   1  630    98 00
JM154 053 1   2  0   3  440   110 00
JM154 054 1   4  0   3  370   130 00
JM154 055 1   3  0   1  320   153 00
JM154 056 1   4 13   1  240   263 00
JM154 057 1   1 14   1  430   285 00
JM154 058 1   1  0   1  510   337 00
JM154 059 1   4 13   1  480   459 00
JM154 060 1   1  0   1  460   220 00
JM154 061 1   1 14   1  300   105 00
JM154 062 1   3  0   1  830    77 00
JM154 063 1   4 13   1 1080   125 00
JM154 064 2 040 060 1100 11781 02000 0077 12500 00168 00080 609 2 0800 02133030
JM154     3 669820 421828 00    046080  10 0136718 0048 0013 .03 .10 .13   0   0
JM154     4   0 .29   0   0   0 .11 .10 .03 .11   0   0 .03 .03   0 .05   0   0
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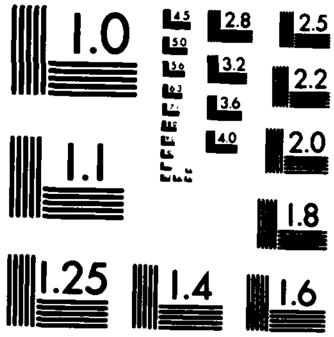

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